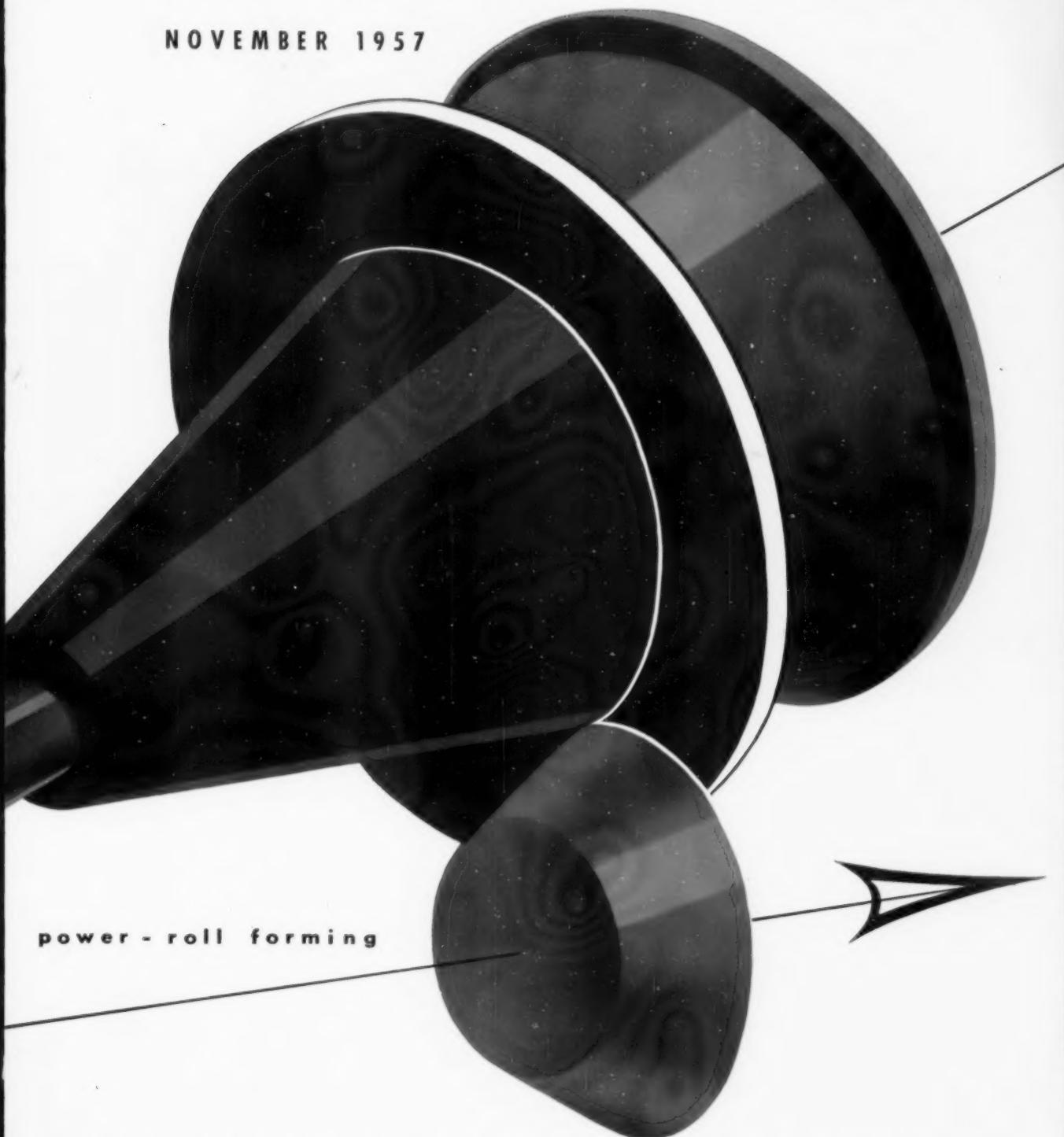


the

# TOOL ENGINEER

NOVEMBER 1957

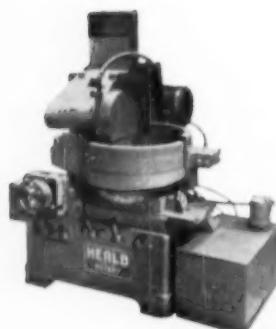


power - roll forming

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



## Large work? Low RMS finish? Here's a shining example.



IT PAYS TO COME  
TO HEALD!



### THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

*The 30" Heald Model 361 Rotary*

*does an outstanding surface grinding job*

Take this case for instance. The column-type rotary Model 361-30" is designed to precision surface grind relatively large work. The wheel grinds on its periphery, producing a concentric finish highly desirable in certain applications. The 361 is now available with either a 24" or 30" magnetic chuck, and can easily handle work of the size shown above. This piece has a 2-4 R.M.S. finish and a flatness of .0001 in 30". Send for Bulletin 2-361-1.

COVER: In power roll forming, material in a blank is plastically deformed to follow the contours of a rotating mandrel. Forming pressure is applied through freely rotating rollers. Details of the process are given in an article beginning on page 107.



# The Tool Engineer

Volume XXXIX, No. 5

November 1957

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PLANNING • ENGINEERING • CONTROL • TOOLING • EQUIPMENT • PRODUCTION

THE TOOL ENGINEER is regularly indexed in the  
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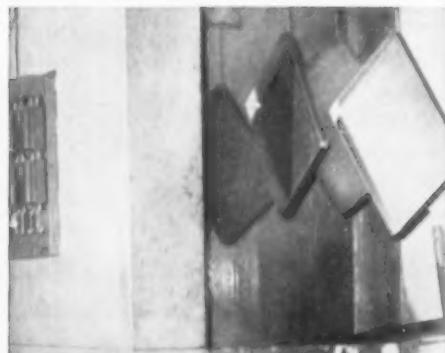
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GRINDING



ROLLING



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## The Miracle at Hannover

HANNOVER: European recovery since the war is an economic miracle. This fact is very evident at the European Machine Tool Show at Hannover. Many companies exhibiting at the show started again from scratch, after the war, yet they are able to exhibit first-class precision machines. Especially conspicuous are the German exhibits, accounting for more than 65 percent of the machines displayed.

Developed on the theme that the machine is the mannequin, the show has no other props nor back drops in the booths. Each booth is marked at the corners with a standard bearing a small card with the company name and the country flag upon it. This is typically European and gives a professional atmosphere to the show. In addition, the operating machines appear to be more natural in a shop setting.

Machine-tool gray has given way to green for a large percentage of the production machines. A soft "vista" green is especially popular. Probably the most outstanding feature of the show, however, is the unusual and extensive application of tooling on the machines. Feeding, work holding, unloading and gaging devices are on many machines and are particularly ingenious. In many instances they were designed and built into the machine as part of it.

Another feature of the show is the effective manner in which the exhibits are arranged. Each exhibition hall displays one type or group of machines. This orderly presentation makes a neat appearance. It attracts the visitor to a more thorough study and assists him in making comparisons. Time spent at a fair is a profitable investment, particularly at this show. It is indeed a dream world for the tool engineer.

A handwritten signature in black ink that reads "John W. Greve".

EDITOR



COMPLETE LINE OF STANDARD & SPECIAL TAPS



PLASTIC TAP BOXES

## PROTECTED QUALITY

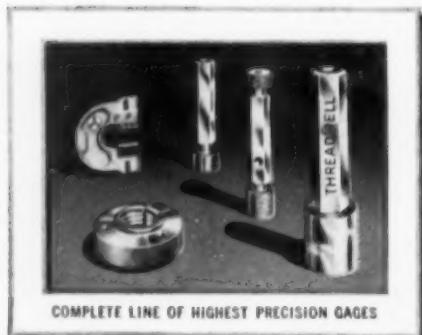
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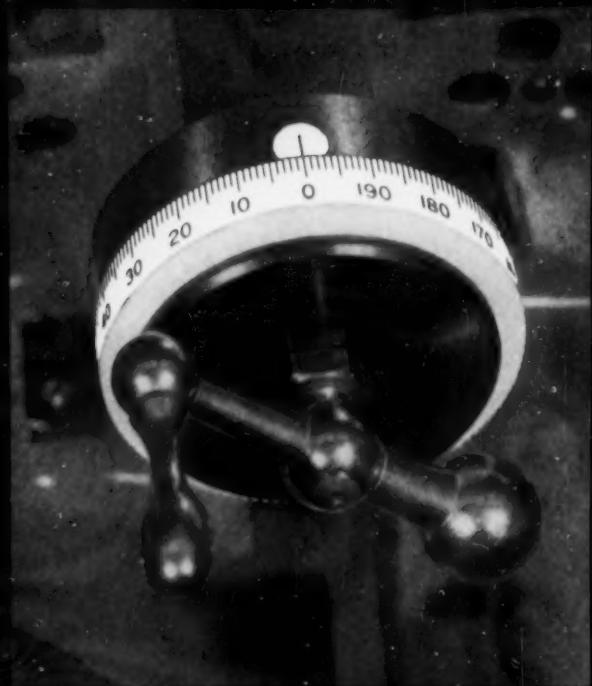
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**BLACK AND  
WHITE DIALS**

**MEAN  
INCREASED  
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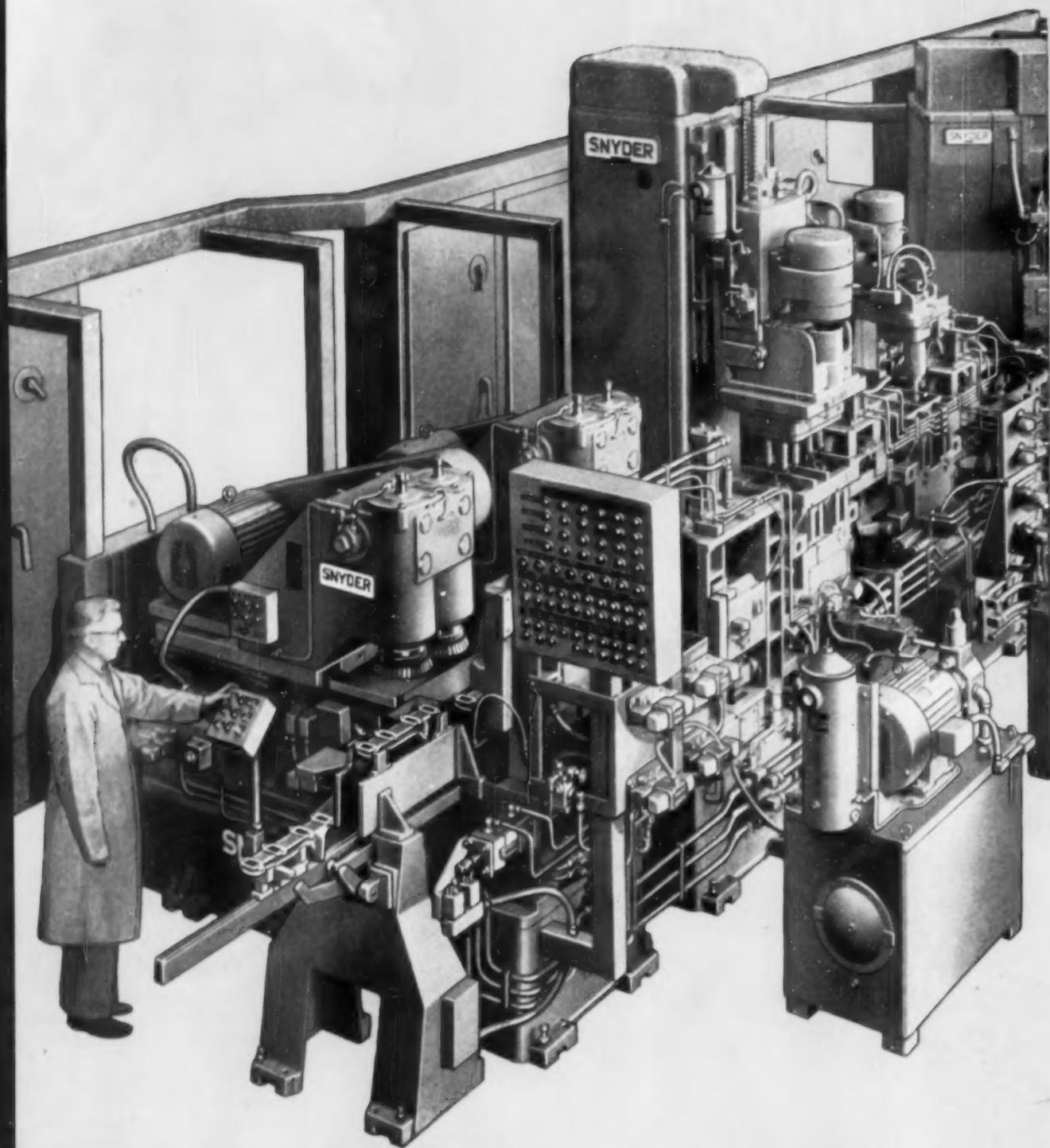
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Pioneered with the Hardinge High Speed Precision Tool Room Lathe model HLV shown here — Hardinge black and white dials are now standard equipment at no extra cost on all of our tool room and production machines.

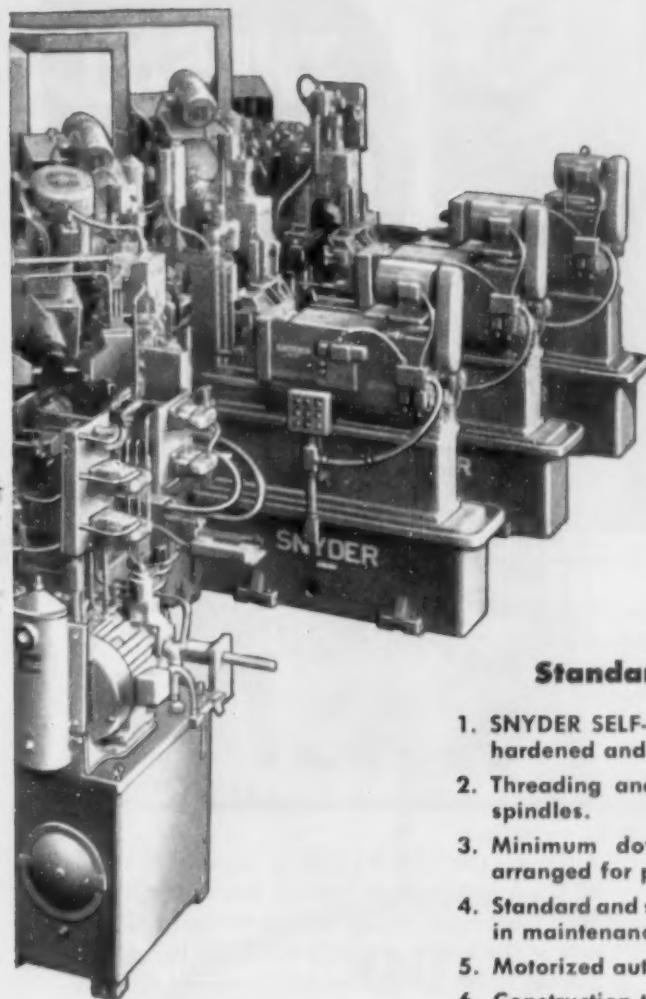
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## Two Different Exhaust Manifolds Processed by Snyder Special



# Simultaneously in Random Sequence In-Line Transfer Machine



## SPECIAL FEATURES

1. Production: 136 manifolds per hour.
2. 28 Stations: Operations include milling, drilling, chamfering, probing and tapping.
3. Manifolds "A" and "B", loaded at random, are identified by built-in sensing devices which activate or idle machining units at appropriate stations as required by the different parts. Parts "A" and "B" are identically processed at Stations 1, 4, 6, 7, 8, 9. At Stations 6, 7 and 9, sensing devices detect Part "B" and bring in automatic clamp support. Both parts are turned over at Station 12. Part "A" is processed at Stations 14, 16, 17, 18, 19. Part "B" is processed at Stations 22, 24, 25, 26, 27 and both parts are unloaded at Station 28 by automation equipment.
4. Individual base segments provide maximum flexibility for future part design changes.
5. Floor space: 63' x 20'.

## Standard Features of Snyder Machines

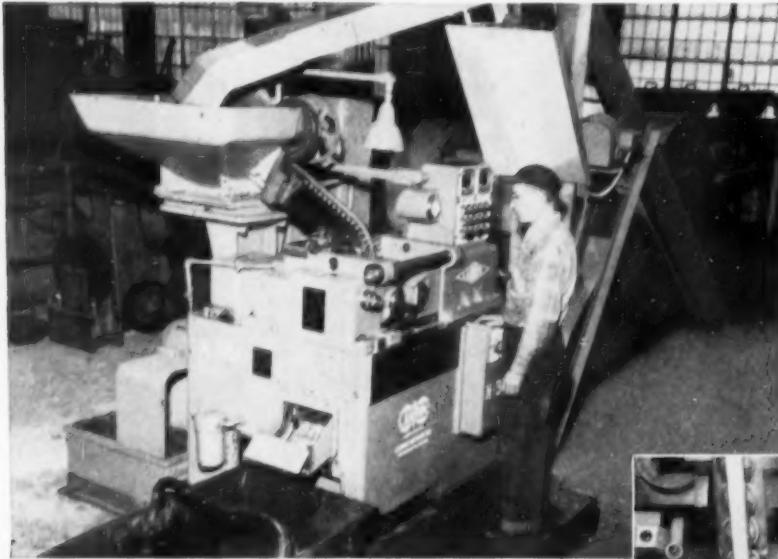
1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground ways.
2. Threading and tap heads equipped with individual lead-screw spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Standard and special parts interchangeable for speed and economy in maintenance.
5. Motorized automatic lubrication system for all moving parts.
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7. Master Push Button Panel and Light Console at Station 1.
8. Each unit equipped with its own push button control station for ease of tool setup and manual operation of unit.
9. Electrical interlocks and full depth circuit throughout.
10. Panels equipped with SNYDER CIRCUIT SLEUTH.

# SNYDER

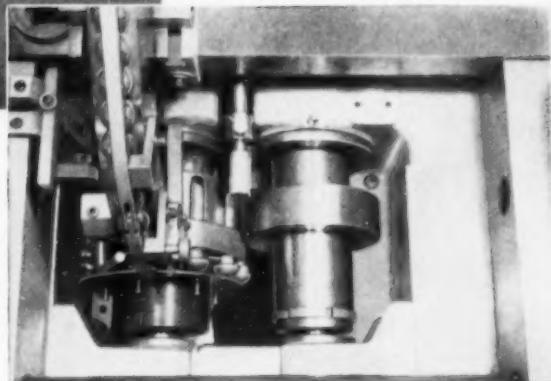
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*32 Years of Special Machine Tools with Automation*

# automated



THREAD  
ROLLING



The automatic features of the LANHYROL Thread Rolling Machine have enabled a large industrial fastener and related parts company to automate its process for producing button head oval neck track bolts.  $\frac{3}{4}$ " 10 pitch UNC threads are rolled  $1\frac{3}{4}$ " in length to Class 2A fit.

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The LANHYROL Machine produces excellent threads at unequalled rates of output, and its method of operation fits well into automated processes. For information on its unusual range and flexibility, and the Infeed and Thrufeed thread rolling methods, send specifications and ask for Bulletin E-60.

494  
**LANDIS Machine COMPANY**  
WAYNESBORO • PENNSYLVANIA

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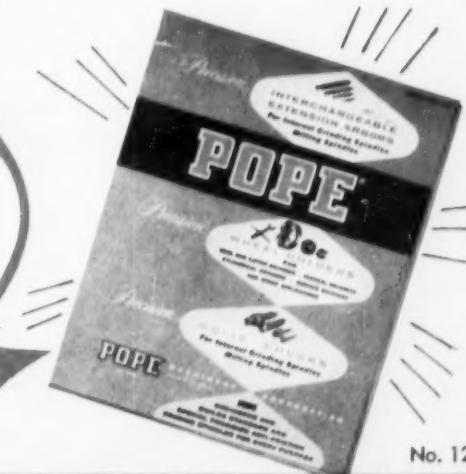


SAVES MONEY >

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It gives you complete information and specifications so that you can quickly select the right Wheel Holders, Extension Arbors and Collet Chucks for your machines and your spindles.



No. 122

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**ultra**



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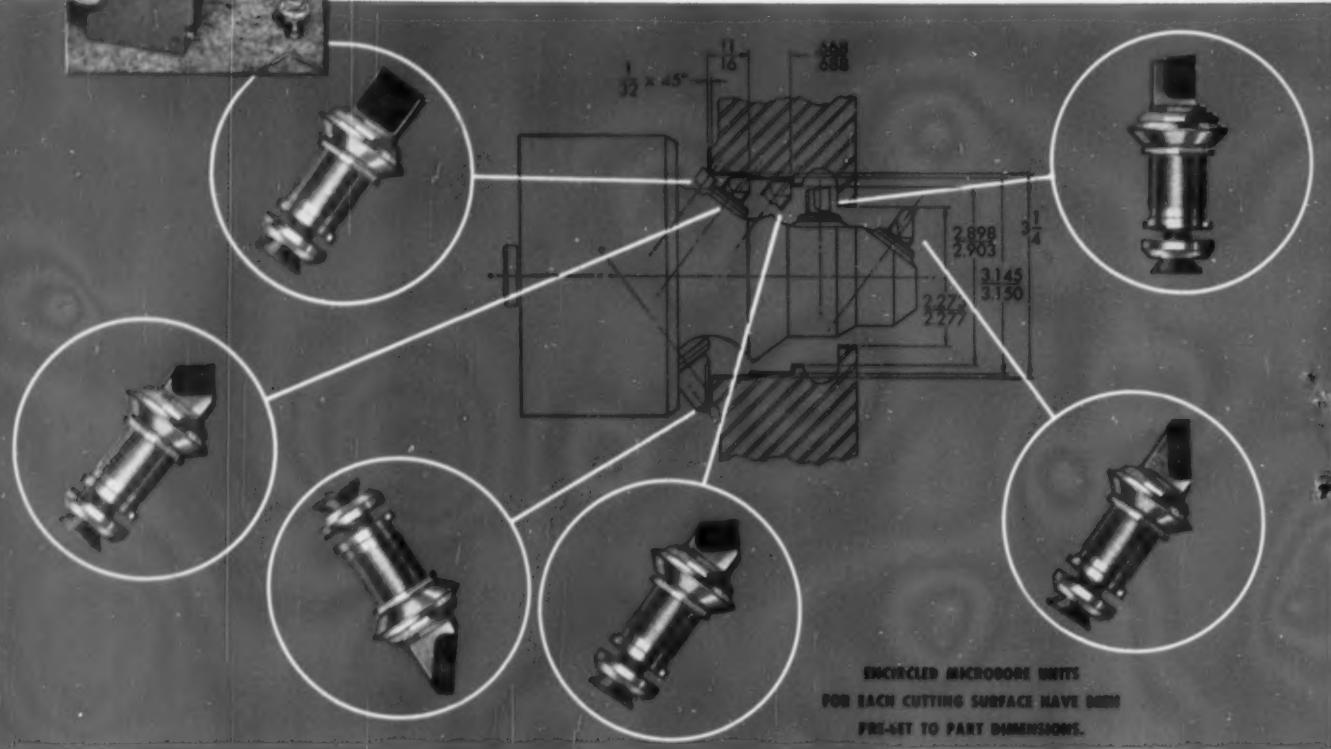
THE AMERICAN TOOL WORKS CO., CINCINNATI, OHIO, U.S.A.

*Lathes and Radial Drills*





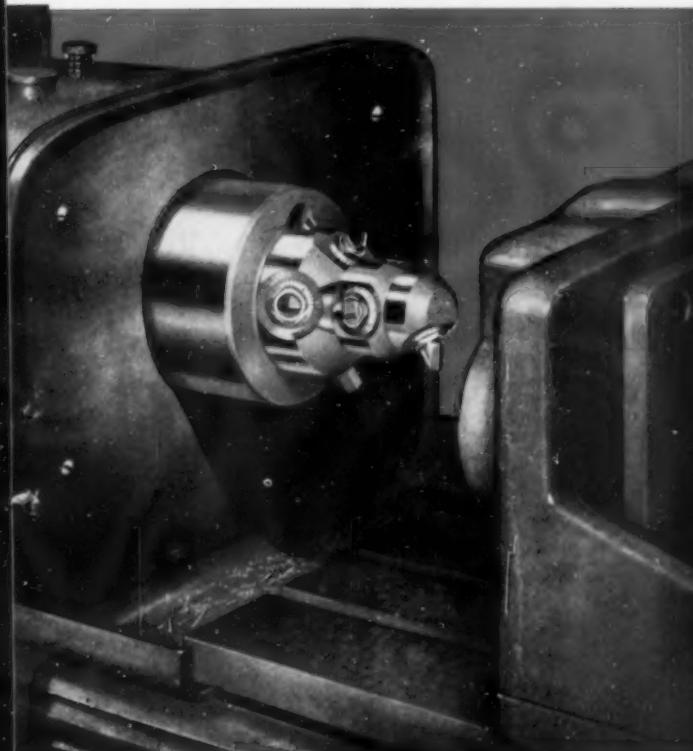
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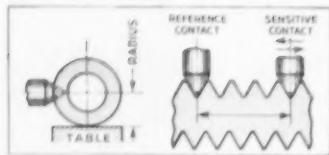
Vertical Boring Machines

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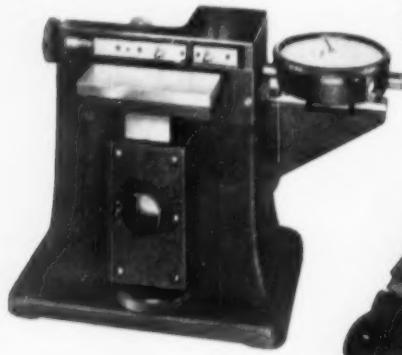
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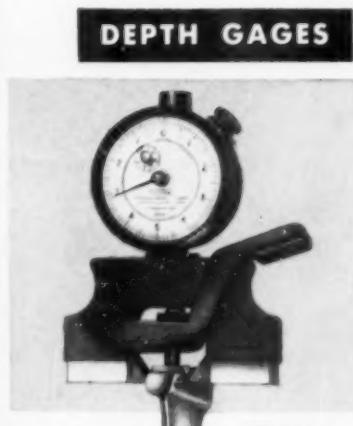


**Thread Lead Gage Model 1141**  
Compares lead of screw threads  
—also spacing of holes, notches,  
grooves, etc.

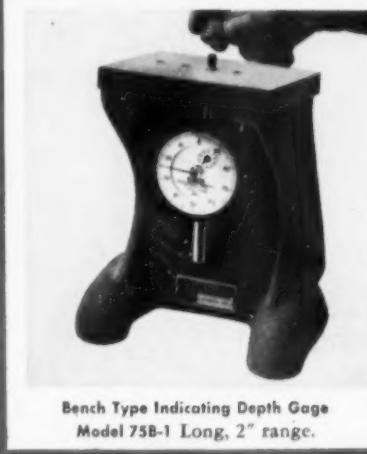


**Pitch Diameter Gage Series 45**  
For fast inspection of pitch diameter of  
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## THREAD GAGES



Modifications  
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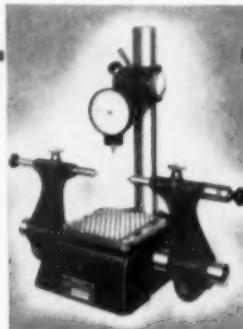
**Bench Type Indicating Depth Gage**  
Model 75B-1 Long, 2" range.



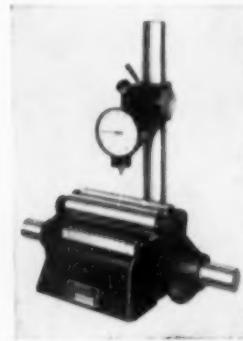
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Universal Dial Comparator  
Model 100B-20

Highly accurate  
instrument. At-  
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greatly extend  
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**The "Super Benchmaster"**  
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Capacity 0" — 3.750". The ultimate in  
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Crankshaft  
Gage Model  
1340P-40

Extremely thin, measures diameter of crankshafts where projections are large and/or closely spaced.

## SNAP GAGES



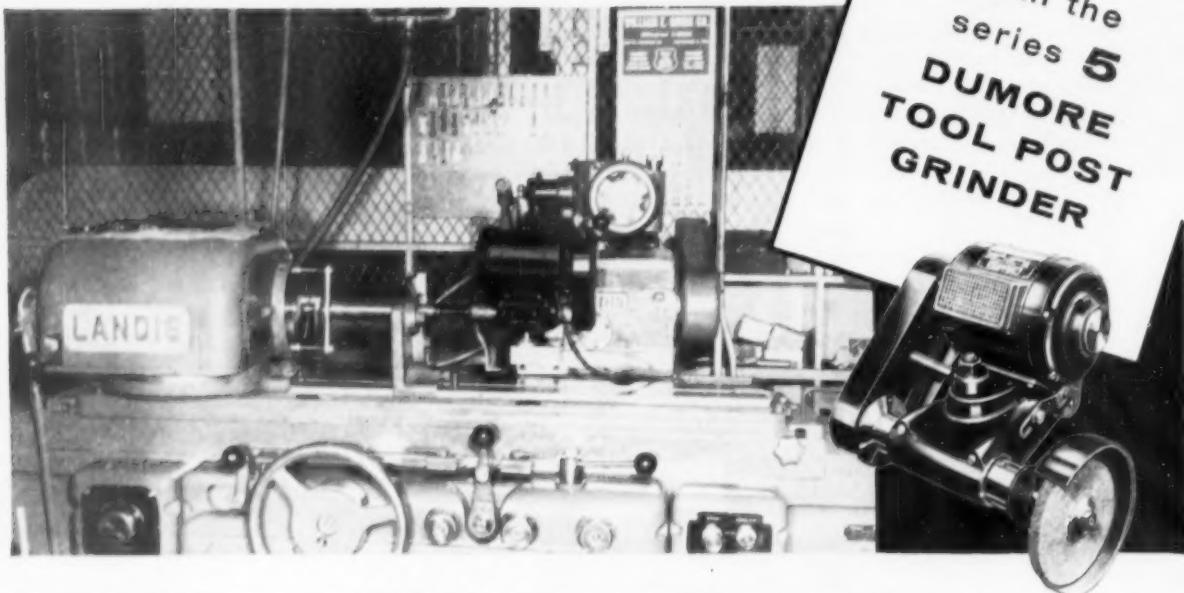
GEAR GAGES

Pitch Diameter  
Gear Gages  
Series 202

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FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

# Add Broader Range, Lower Cost INTERNAL GRINDING Capacity to Your Plain or Universal Grinders...



with the  
series 5  
**DUMORE**  
**TOOL POST**  
**GRINDER**

By merely attaching two Series 5 Dumore Tool Post Grinders to the spindle housing on each of two standard grinding machines, a Midwestern manufacturer gained a far wider range of internal grinding capacity at much lower cost than other methods.

The first unit is attached to an old standard grinding machine by means of a simple, angle bracket. *Result:* a long-forgotten machine turned into a high production, precision internal grinder, saving the cost of purchasing a new machine. The second Series 5 unit is added to a brand new standard grinding machine by the same type bracket. *Result:* the company obtained the additional internal grinding capacity needed as well as the external grinding machine required, for less money!

Eleven quick-change quills with available speeds from 4600 to 42,500 rpm and wheel capacity from  $\frac{1}{8}$ " on shallow work to  $1\frac{1}{8}$ " at 18" deep . . . give the Series 5 its remarkably high versatility for hundreds of internal grinding jobs. What's more, the total cost for this equipment is a great deal less than for any other with comparable .0001" accuracy and surface finishes of 6 to 8 micro-inches.

The Series 5 Dumore Tool Post Grinder has a  $\frac{1}{2}$  hp distributed field, continuous duty rated universal motor and can handle wheels from  $\frac{1}{8}$ " to 5". You can use it for *both* internal and external grinding operations. Simplified mounting permits you to shift it quickly from one job to the next, or from one machine to another.

**MOUNTS ON ANY BASIC MACHINE TOOL . . .** planers, shapers, mills, grinders and lathes with 13" to 18" swing . . . to provide precision grinding equipment at low cost. In addition, it can be easily adapted to special-purpose set-ups for special jobs. Eight other models available, 1/5 to 3 hp, for every size of basic machine and grinding job. Write for catalog.

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You can do more grinding with Dumore Grinders on *any* machine tool



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PRECISION TOOLS

THE DUMORE COMPANY 1310 Seventeenth St., Racine, Wisconsin

AUTOMATIC DRILL  
and TAP UNITS  
PORTABLE MILLING UNITS  
MICRO-DRILLS  
TOOL POST and  
HAND GRINDERS



#### DUMORE HAND GRINDERS

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- Built best, priced right

Lightweight, compact, balanced to minimize vibration, ample power. 5 models—1/20 to 1/4 hp . . . a grinder for every job.



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- QUALITY BUILT FOR LONG LIFE

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Machined from solid bar stock. Close tolerance operation control. Free-running spindles regardless of heat, speed or hours of use. Use with Dumore Grinders or—as heads in special set-ups, as replacement spindles or high speed attachments. 5 basic types.

FOR MORE INFORMATION ON THESE PRECISION TOOLS—WRITE FOR CATALOG

# Production Pointers

from

# GISHOLT



TIME-SAVING IDEAS

*Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.*

## FISHER GOVERNOR CUTS TIME ON VALVE PARTS

### Hydraulic drive gives turret lathes completely automatic operation

How important is a planned equipment replacement program? Here's a concrete example:

The Fisher Governor Company's Marshalltown, Iowa, plant—one of the most modern in the Midwest—adds almost \$500,000.00 annually in new and improved equipment. In effect many years, this program pays off in improved quality, lower production costs, and a stronger competitive position. Recent additions are two Gisholt No. 5 MASTERLINE Ram Type Turret Lathes, equipped with hydraulic drive units to make the machines completely automatic.

Here's how they are used to produce 1"-size valve bonnets from 2½" steel bar stock. For the first operation, stock is automatically advanced through the spindle and gripped in a collet chuck. All external and internal surfaces in section A are then machined by hexagon turret and cross-slide tooling. Reverse-feed is used to finish-turn and finish-bore.

Chips are removed during drilling by reciprocating action of the hydraulic control, withdrawing the drill automatically at predetermined intervals. The drill is then rapid-traversed back to where it stopped drilling before resuming feed. The large O.D. is threaded from the hex turret, using a self-releasing die-head automatically recocked after each threading operation.

Internal grooving operations are handled by a turret-mounted slide tool, actuated during turret movement by an overhead positive stop. At the end of the cycle a basket on the final turret station catches the part as it is cut off, and the cycle auto-

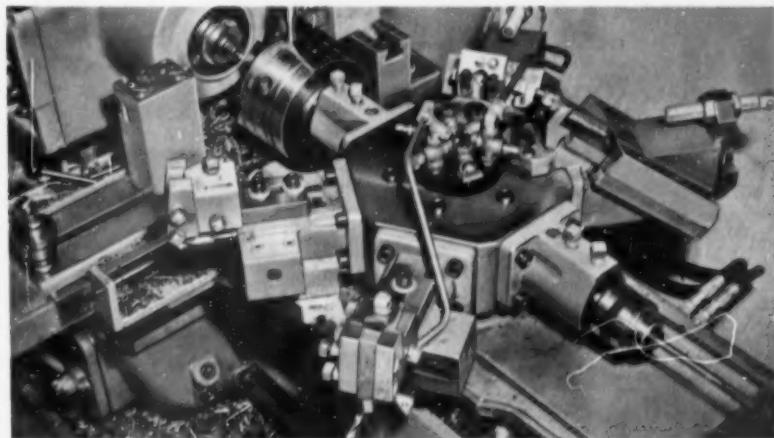
matically repeats until new bar stock is needed. Floor-to-floor time is a fast 3.6 minutes.

The second No. 5 lathe, equipped with a collet chuck, handles machining operations on the other end. Hexagon turret and cross-slide tools machine all internal and external surfaces in section B. The small O.D. is threaded and grooves formed in the

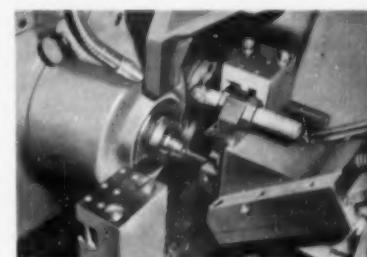
small bore by the same methods as in the first operation. Floor-to-floor time is just 2.4 minutes.

**One operator handles both machines.** Hydraulic drive provides completely automatic operation; repeats tolerances piece after piece; offers uniform quality, longer tool life.

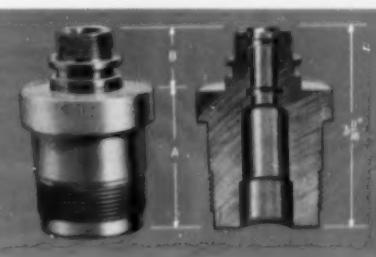
Ask for new Catalog 1182-A on Hydraulic Drive for Ram Type Turret Lathes.



Second operation tooling. All machine functions automatically controlled by automatic drive, including necessary spindle speed changes for threading, reaming, grooving, turning and drilling operations.



Close-up shows special slide tool, actuated by overhead stop. Forward movement of turret translated into vertical movement of tool to perform internal grooving.



Two finished valve bonnets. One on right is sawed in half to show all surfaces machined in both operations.



### TIME-SAVING IDEAS

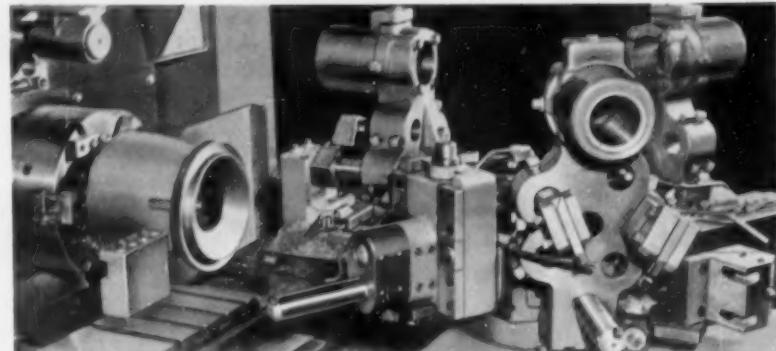
This setup demonstrates how Byron-Jackson Division of Borg-Warner Corporation, Lawrenceburg, Ind., uses an automatic turret lathe to handle five different sizes of cast iron pump cases, machined in lots of 1,000. The first operation, on a typical part  $10\frac{3}{32}$ " long and  $1\frac{1}{4}$ " in diam., is shown.

The work is located from the end and chucked in the large I.D., using a three-jaw air chuck. Standard tools on the hexagon turret and front and rear cross slides handle straight turning, facing, boring and chamfering operations on the flange end. A turret-facing attachment on the rear cross slide operates two special turret-mounted facing slide tools, to rough and finish the tapered face. Tools for boring, shave-facing and forming are carried on the same turret station. The bore is completed at a high RPM. Then the spindle changes to a lower speed as the tools face and form and then dwell to clean up the cuts.

A fixture is used for the second operation. An adapter centralizes on

## BYRON-JACKSON DIVISION MACHINES PUMP CASES 75% FASTER

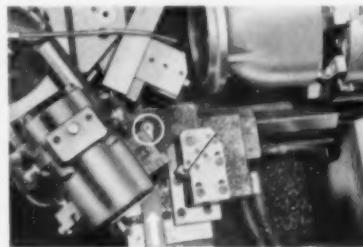
### Special slide tools on 2F Fastermatic speed taper facing



Five different pump casing sizes handled with similar setup. First operation shown. Overhead piloted tools used for greater accuracy on multiple cuts.

the machined hub, locating against the finished flange face as draw-back clamps hold on the opposite side. The turret-facing attachment and special slide tools again machine internal surfaces which cannot be reached by standard tooling. A low speed and dwell again cleans up a shave-facing cut. F.t.f. time 7.5 minutes.

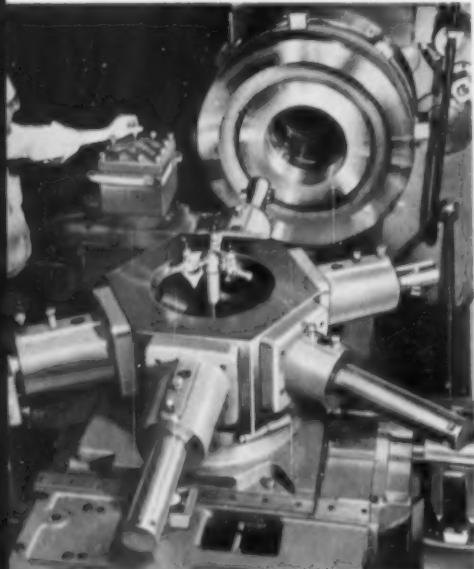
*Special slide tools face taper accurately at low cost. Change to low spindle speed and dwell at end of cut cleans up surfaces, promotes greater accuracy, saves extra passes at the work.*



Special turret-mounted facing slide tool is operated by turret-facing attachment on rear cross slide. Operating end of pusher arm encircled. Tool carrying slide set at angle to centerline for desired taper on face.

## MANNING, MAXWELL AND MOORE CUTS TIME 71%

### Speeds production on 32" wheels with special 5L lathe



Note size of part compared to operator. Cross-feeding turret on the Gisholt 5L permits use of standard tools for cross-facing and grooving operations.

This job story shows how a seven-hour f.t.f. time was reduced to two hours. It reveals how Manning, Maxwell and Moore, Inc., Shaw-Box Crane & Hoist Division, of Muskegon, Mich., uses a Gisholt 5L with a 50 h.p. drive motor to gain full advantage of the versatility and operating economy of a horizontal turret lathe on operations requiring heavy stock removal.

The 5L is equipped with a raised headstock and hexagon turret, providing 45" swing over the ways to handle a variety of large-diameter parts. Cross-slide travel is  $18\frac{1}{2}$ " out from the center line. A cross-feeding hexagon turret permits use of standard boring bars and tools to handle grooving operations, cross-facing, etc. "Tenth" indicators and longitudinal feed dials on the cross-slide and turret carriages speed tool positioning. Taper attachments on both carriages simplify angular turning and boring. A chasing attachment on the turret carriage assures accuracy in threading operation.

Let's look at the setup for a typical part—a 32"-diameter,  $6\frac{1}{2}$ "-wide rolled steel control gate wheel heat-treated to 321-363 Brinell. These wheels are for the St. Lawrence Waterway System, and used in the "Shaw-Box" line of overhead traveling cranes. Four hand clamps on the O.D. of a 32", four-jaw independent chuck pull the part back, locating it against the chuck jaw faces before chucking. The square turret on the cross-slide handles all O.D. taper turning and forming cuts. Hex turret tools cross-face and bore, groove the center of the  $12\frac{1}{2}$ " bore, and machine a 2 t.p.i. oil groove for the length of the bore. The part is then reversed and similar facing, turning and forming are performed on the other side to complete the job.

*This setup removes 270 pounds of metal in two operations, saving five hours over previous methods. Again, a new machine with sufficient capacity, horsepower and proper accessories has meant lower production costs and new operating economy.*



LOOK AHEAD...KEEP AHEAD...WITH GISHOLT

# TO PROFITABLE PRODUCTION

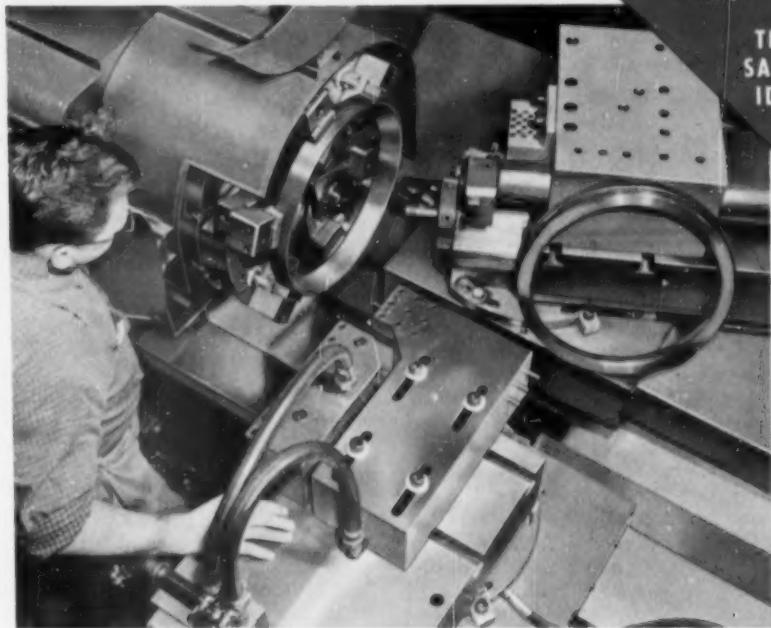
## TORRINGTON SPEEDS BEARING RACE MACHINING 30%

**Handles variety of types and sizes with minimum change-over on No. 24 Automatic**

You'll spot cost-saving ideas here for machining large-diameter, thin-wall parts. The Torrington Company's South Bend, Indiana, plant is using this setup on a Gisholt MASTERLINE No. 24 Automatic Production Lathe to produce a variety of inner and outer bearing races.

To hold the parts without distortion, a 24", three-jaw air chuck grips at six points on the O.D. Each chuck jaw mounts a pie-shaped swivel plate carrying two top jaws with loosely held steel contact pads. The part locates against the back of the top jaws, with the contact pads automatically adjusting themselves to irregularities and—working with the swivel plate—equalizing pressure to centralize the part during chucking.

In the first operation on the No. 24, this 15 $\frac{3}{4}$ "-diameter outer bearing race is faced on one end and the O.D. turned up to the jaws. In the second operation (illustrated), the part is chucked on the previously machined O.D., locating against the machined face. Using standard longitudinal carriage feed, tools on the front slide turn the remainder of the O.D. Then, standard slide movement feeds the tools transversely, out from center, facing the end and forming an inside radius. Tools on the rear independent slide then taper-bore and form



TIME-SAVING IDEAS

15 $\frac{3}{4}$ "-diameter outer bearing race in chuck. First operation part at right. Note elongated slots on front tool block and boring tool holder, designed for quick adjustment to handle variety of work sizes.

a radius on the O.D. to complete the operation. Floor-to-floor time on this well planned job is a fast, profitable three minutes.

Swivel bases on front and rear slides speed angular setting. With facing and forming tools on the front slide in separate adjustable block, and boring tools on the rear slide in

adjustable bar, setup is faster for a variety of part diameters requiring different length cuts.

**This machine handles 60 different part sizes. Chucking arrangement eliminates distortion, improves accuracy. Swivel base tool slides and adjustable tooling speeds change-over, helps reduce over-all f.t.f. time 30%.**

## HOW SIMCA SIMPLIFIES CRANKSHAFT BALANCING

**End drive on 3S Balancer speeds handling of crankshafts**

With the installation of two Gisholt 3S Balancers, Automobiles SIMCA, Nanterre (Seine), France, has stepped up crankshaft balancing operations. To speed loading and unloading of the relatively long workpieces, a special end-coupling type of drive is used on the machine, rather than the standard belt drive.

The end-drive coupling has an angularly graduated driving pulley in the housing below the direct reading amount meter. Angle of unbalance is indicated by the strobe lamp, and the amount of correction needed is shown by the direct reading amount meter—which is calibrated in terms of method used to correct the part (in this case, by drilling).

After a part is rotated and checked for unbalance amount and angle, the operator removes it from the machine and corrects it on a drill press. With each operator measuring the amount of unbalance and the angle, and performing his own correction, possibility of error is minimized. This arrangement permits balancing 50 to 52 crankshafts per hour with the two Gisholt 3S Balancers.

**Gisholt Type S Horizontal Balancer readily adapts from belt drive to end drive, with no loss in accuracy—ideal for long workpieces not adaptable to rotation by standard belt drive. Amount meter calibrated in terms of correction drill depth eliminates lengthy computation by the operator.**



Crankshaft shown arranged with end drive which speeds loading and unloading. Note strobe angle-indication lamp and amount meter in the same visual plane to assure quick, efficient reading.

**TALK TO GISHOLT ABOUT MACHINE TOOL LEASING**





TIME-SAVING IDEAS

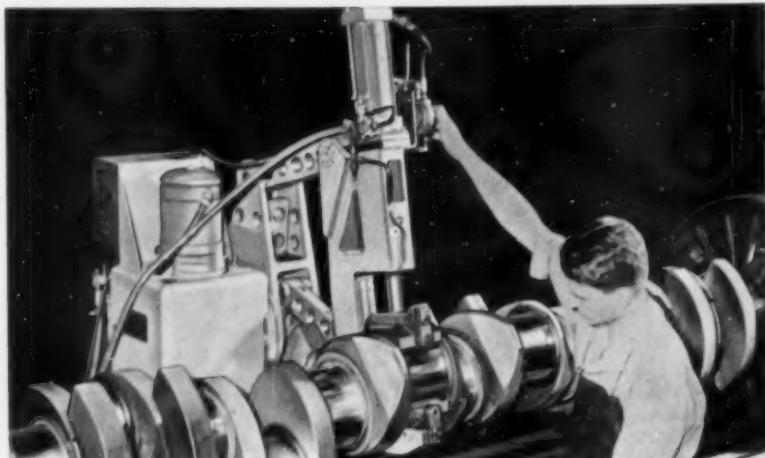
## VAN DER HORST SAVES \$15 PER BEARING SURFACE WITH SUPERFINISH

Refinishes  
crankshafts with  
No. 4 Superfinisher  
attachment on lathe

Here's how Van Der Horst Corporation of America, Olean, New York, uses Superfinish to cut reconditioning costs and provide smoother, longer wearing bearing surfaces, on crankshafts, for locomotive diesel engines.

The part shown is typical. All bearing surfaces are chrome-plated and then refinished to original dimensions. Previously, the bearing surfaces were chrome-plated .015" oversize to permit refinish by grinding. Superfinishing has reduced the extra chrome requirement to only .002" in excess of finished diameter. This, plus the much lower cost in machine tools, permits a saving of \$12 to \$15 for each pin or journal surface handled.

To do the job, a Gisholt No. 4 Superfinishing attachment, equipped with a latch-on type follower arm, is mounted on a lathe carriage. This assures a rigid mounting base for the attachment and permits fast, accurate placement anywhere along the part, which is held between centers.



Pin, main and journal bearings on these crankshafts are handled easily by No. 4 Superfinisher attachment with latch-on follower arrangement.

The follower-type arm holds the Superfinishing stones in contact with the bearing surface. Each bearing is handled individually. All nine diameters on this part are finished in approximately four minutes each, with one minute to move and set up the attachment for the next diameter. Superfinishing provides a final surface finish of 5 to 10 micro-inches RMS, assuring long surface life and better bearing load capacity.

Relatively inexpensive Superfinishing attachment mounted on existing equipment permits dramatic cost savings in chrome-plating...performs work which would otherwise require special crankshaft grinding equipment costing many times more.

Ask for new 44-page Superfinisher Catalog 1169-B. Includes revised material from original textbook "Wear and Surface Finish," machine information, job applications.

## HARVESTER'S MILWAUKEE WORKS SOLVES CLOSE-QUARTER MACHINING JOB

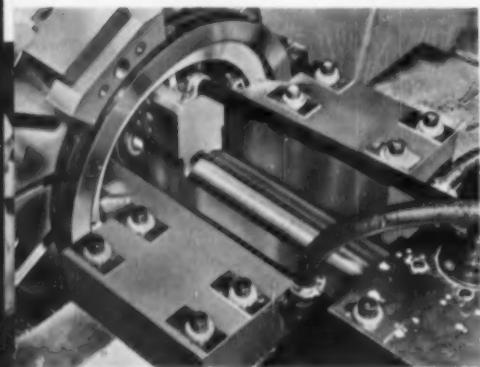
### Simplimatic's platen table permits 7 tools in 15 $\frac{1}{4}$ " I.D. of forging

This story reveals how the problem of positioning slides for multiple cuts in a relatively small bore was solved for International Harvester's Milwaukee, Wisconsin Works. The part is a steel bull gear forging.

The machine, a Gisholt MASTER-LINE Simplimatic Automatic Lathe, was furnished with three short tool slides with adjustable tops. The flat platen table permitted mounting the slides close to the work for maximum support. The part is held in a 24", three-jaw chuck, which has a roller-bearing pilot bushing to support the boring bar on the center slide. A flat ground on this bar lets front and rear slide tooling be very close to the center line, permitting entrance into the bore before machining begins.

Here's the machining cycle: Platen table traverses slides to work, positioning all tools inside rough bore. Rear slide feeds away from center to rough-straddle-face and rough-form the web. Front slide feeds away from center to finish-straddle-face and finish-form. At same time, center slide rough and finish-bores, and chamfers I.D. with tools on piloted boring bar. The spindle stops to eliminate spiral toolmarks and the slides retract. Table traverses back to starting position, clearing the chuck for unloading. F.t.f. time is held to 2.80 minutes.

Again, Simplimatic handles special machine functions at standard machine cost. Seven tools on 3 separate slides simultaneously enter and machine in 15 $\frac{1}{4}$ " I.D. to assure parallelism between front and rear faces.



Compact tooling arrangement permits machining within relatively small bore of part.

Ask for new Simplimatic Catalog 1159-B. Complete machine information; job application section.

No. 11-1257  
691



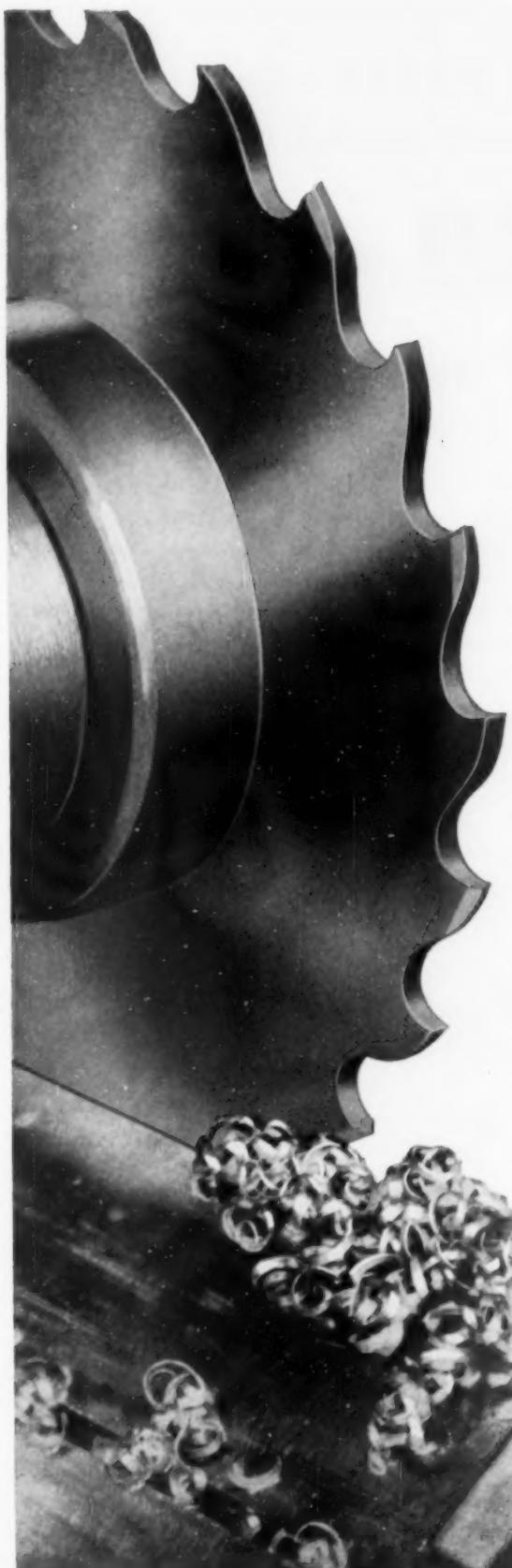
THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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MACHINE COMPANY

Madison 10, Wisconsin

Printed in U.S.A.

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Cutting Tool Manufacturing Division  
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on the **LAPOINTE** 15-ton FP

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Serrations in a tapered hole are easy and economical to produce — if you do the work *in one pass* on this special Lapointe Vertical Broaching Press. Built with variable speed and 30-inch stroke, the machine *broaches and swages 2 holes per minute* on a completely automatic cycle: **A.** broaching speed of 15 feet-per-minute, **B.** swaging speed of 2 feet-per-minute, **C.** broach-return at 20 feet-per-minute. The taper on the top of the broach (see area in circle on photo) flares the serrations, maintaining true alignment.

Eight different parts, both right-hand and left-hand are accommodated by the strip broaching fixture. With the broaching fixture, the broaches, and the broaching press all engineered and built by Lapointe, full responsibility for the entire broaching program is placed right where it belongs: *on Lapointe!*

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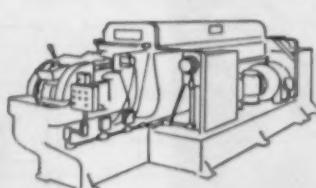
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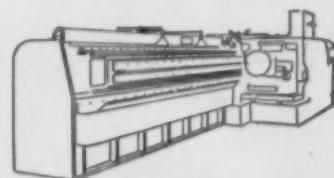
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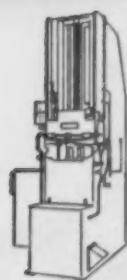
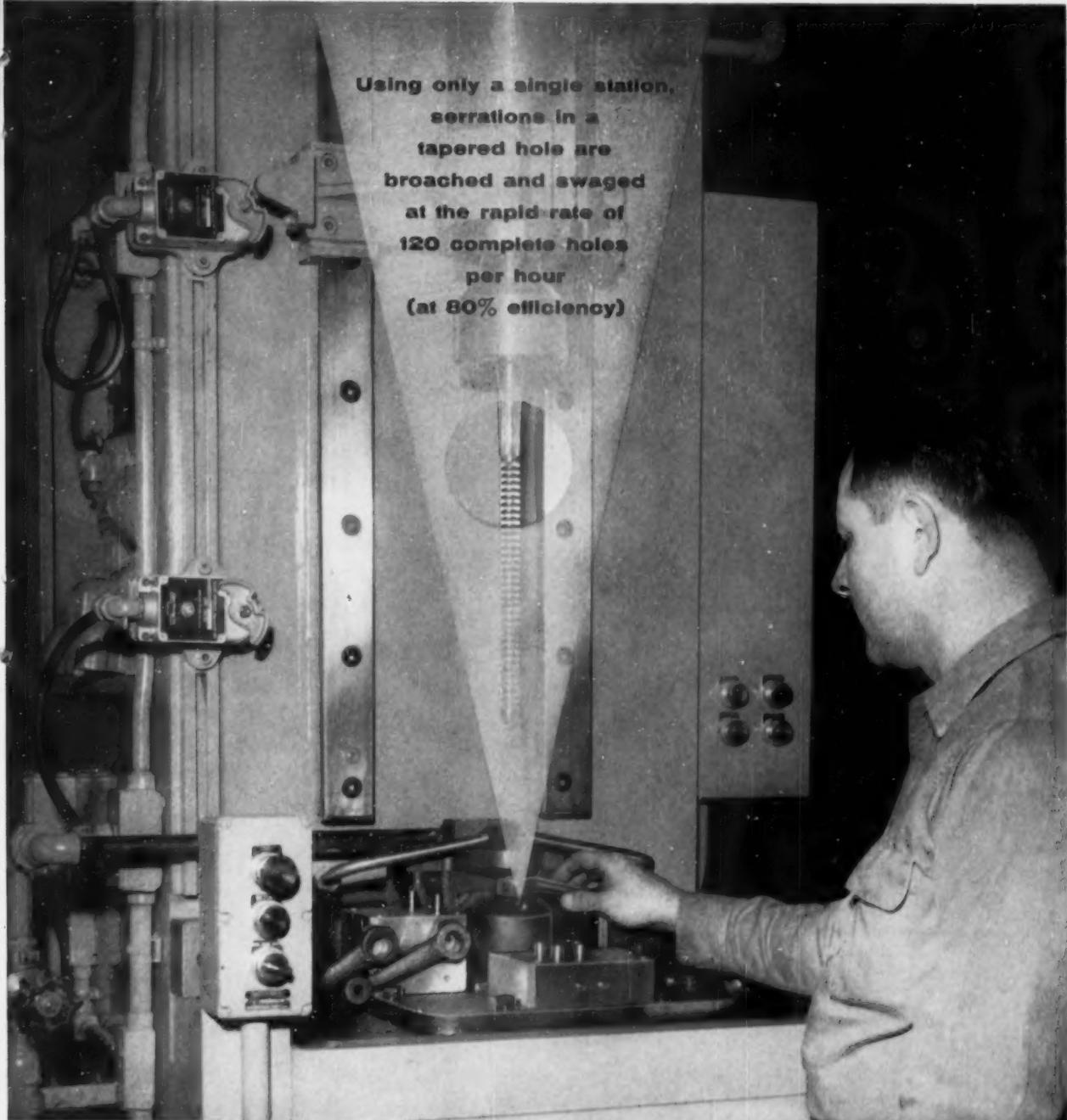


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Using only a single station,  
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at the rapid rate of  
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per hour  
(at 80% efficiency)



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FULL-UP ELECTRIC



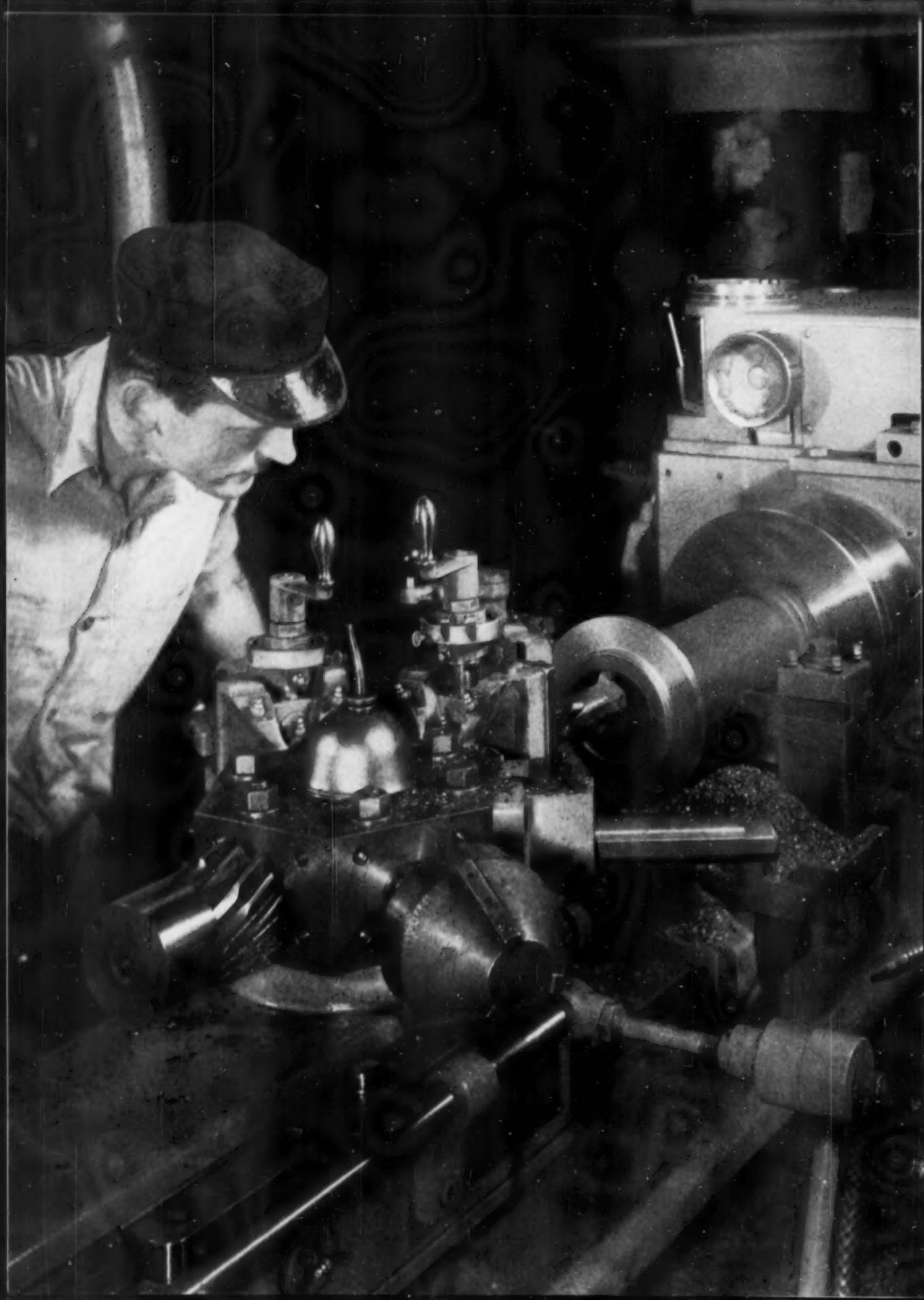
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VERTICAL, ELECTRIC



DRIVE DOUBLE RAM  
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## Equipment Modernization Program Pays Off

- Features New Warner & Swasey No. 4 Ram Type Turret Lathe
- Eliminates Seven Obsolete Machines • Provides \$12,000 Annual Direct Labor Savings

**T**O KEEP PACE with today's expanding economy, progressive small shop operators are taking a closer look at their existing production facilities. Many now realize that a sound replacement policy can pay off in increased production—and profits, too. They are able to stay competitive while maintaining, or even increasing, product quality.

A case in point is Chicago's Emil J. Paidar Co. This leading producer of barber equipment installed a new Warner & Swasey No. 4 Ram Type Turret Lathe as the "keystone" of their recent modernization program. With their existing Warner & Swasey 3-A Turret Lathe, it permitted handling of all turning work on hydraulic cylinders and stems (pistons) used in Paidar barber chairs.

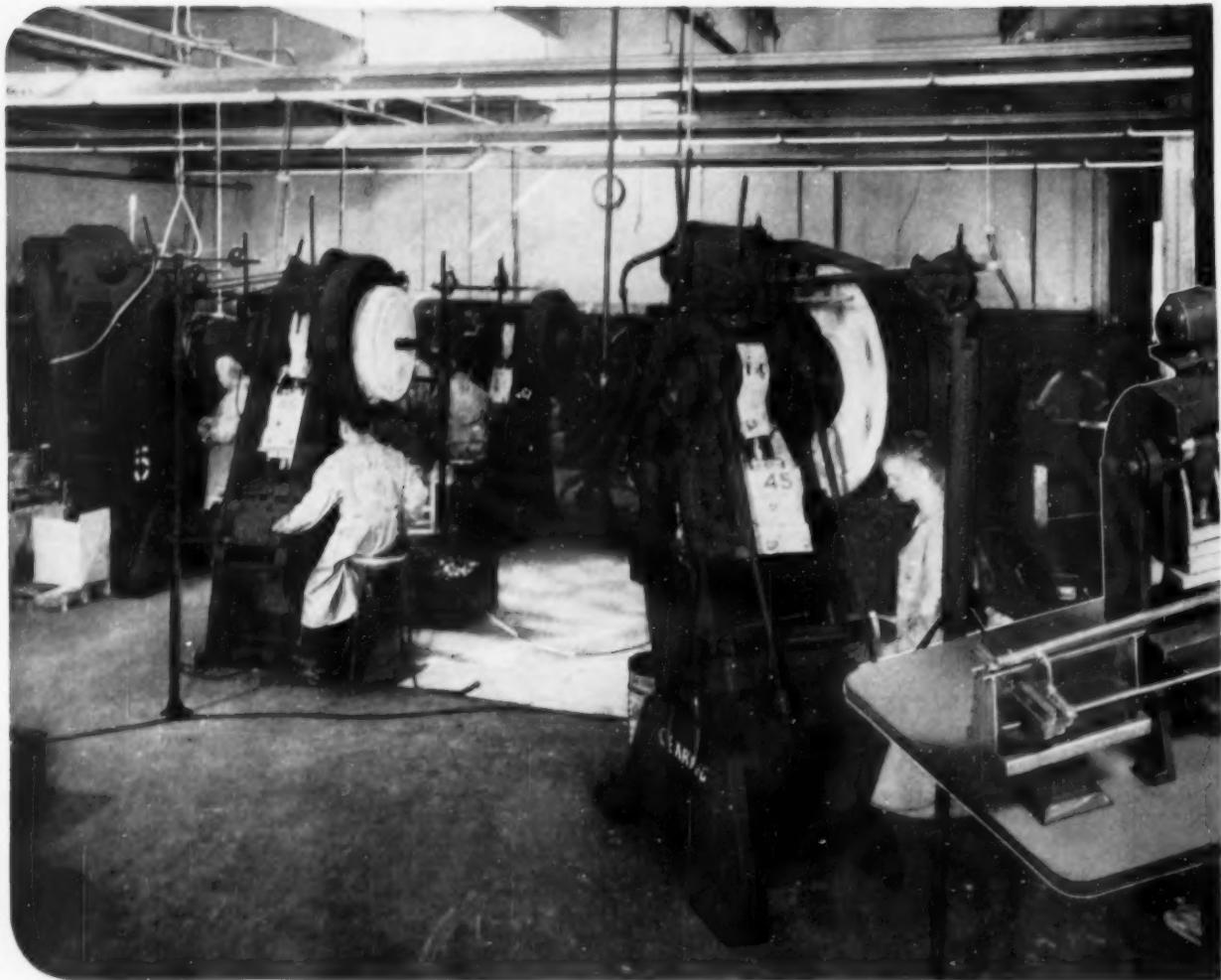
### THE RESULTS:

- Replaced seven machines (old turret lathes, engine lathes, boring machines).
- Reduced the number of operations performed on parts because of the new turret lathe's increased accuracy and versatility over the older equipment.
- Decreased handling time on parts, because all turning is now done on two machines instead of seven.
- Increased accuracy, improved quality of the product.
- Gave increased factory space by producing more work on fewer machines, occupying less space.
- And last, but not least, in addition to indirect savings from above items, a direct labor savings of \$12,000 per year has also been realized.

Why not let a Warner & Swasey Field Engineer prepare a detailed analysis of your present turning equipment now—it costs you nothing, only a phone call or letter.



You can produce it better,  
faster, for less...  
with a Warner & Swasey



## Here's Another Clearing TRANSFLEX idea that

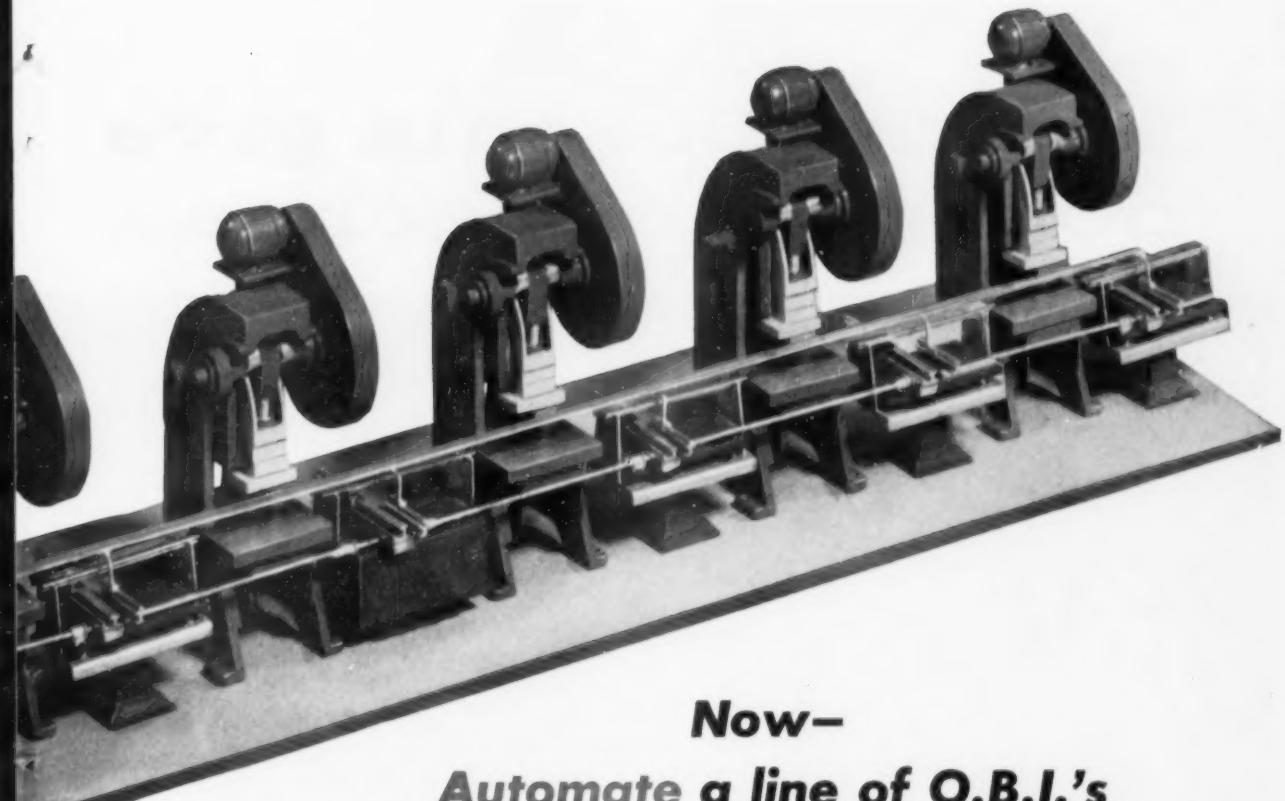
Did you ever think of the productive possibilities of turning a group of O.B.I.'s into a speedy, automatic transfer machine? That's exactly what Clearing has done in the new O.B.I. transflex setup. As few as two or as many as seven or eight O.B.I.'s can be unified into a single automated group.

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jobs. That's right, O.B.I. transflex is flexible enough for a job shop. And it doesn't tie up a lot of capital in single purpose equipment.

*Want to get specific about this new Clearing Transflex idea? Just tear out this page and send it to Clearing. We'll send this bulletin on O.B.I. Transflex right away.*



# **PRESSES**

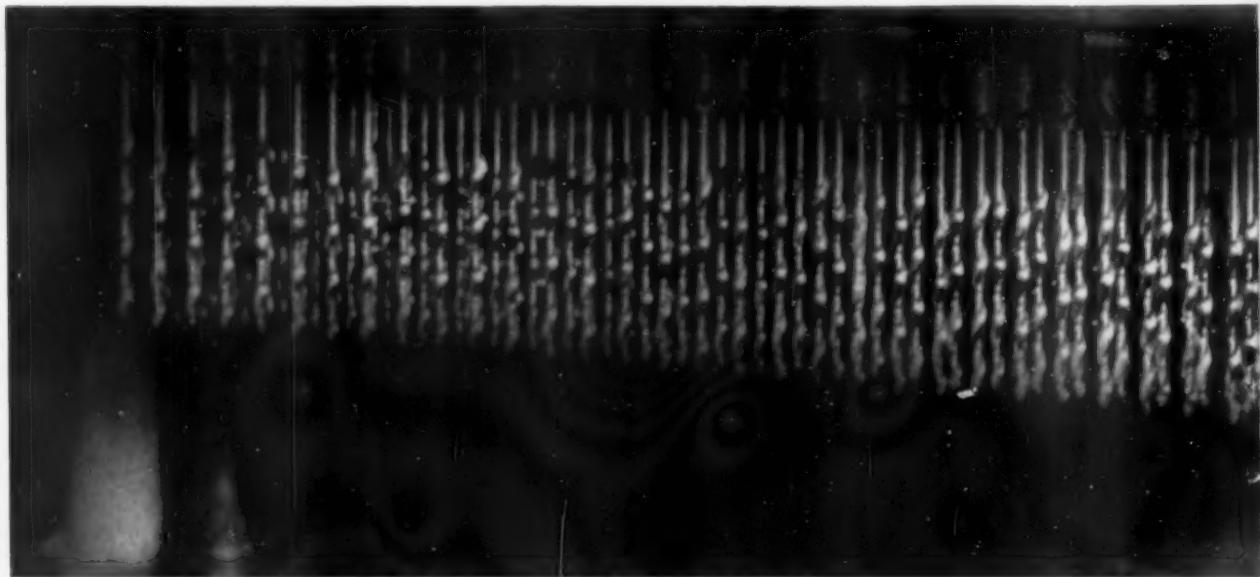
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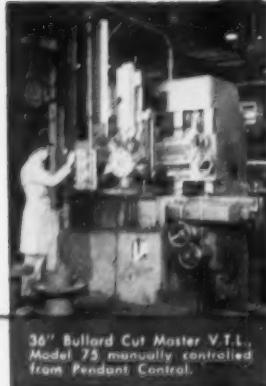


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Model 75 manually controlled  
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with*

**BULLARD**

## VERTICAL TURRET LATHES

*Model 75*



Bullard Service Engineer guides  
Man-Au-Trol Conversion Unit  
into place.



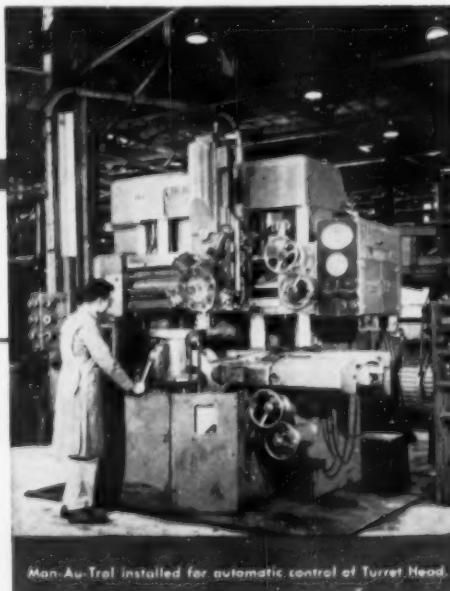
Electrical connections for Man-  
Au-Trol are wired into Cut  
Master Control Panel.

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THE  
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*another way to cut costs when  
cutting metal — buy BULLARD*



Man-Au-Trol installed for automatic control of Turret Head.



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leaves a smooth finish

**AMERICA'S MOST VERSATILE FILE!** It can be used on many jobs; filing stainless steel, cast iron, aluminum, brass, bronze, magnesium, plastics and other materials . . . even filing brass and steel interchangeably without dulling.

**HELLER MULTI-KUT FILE FEATURES** include: bastard tooth spacings for removing the most stock per stroke . . . chip breaker rows to reduce loading and speed filing . . . broad chisel teeth to generate smooth surfaces.

**SEEING IS BELIEVING!** Comparative on-the-job tests prove that Heller Multi-Kut files do the work of Hand, Mill and Flat bastard files, also Brass files . . . giving better results at lower cost.

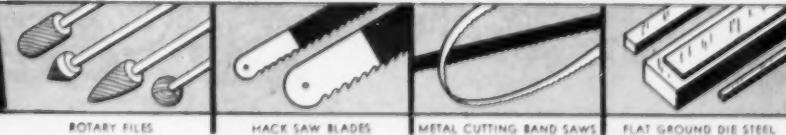
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Cost reduction programs call for such original Heller file developments as Nucut "Wavy Teeth" — "Multi-Kut" — "Spiral-Cut" Half-Round and others. All are designed to give you more filing per dollar . . . with smaller tool crib inventories. Ask your Heller Distributor to help you set up a shop test of Heller Files against all comers. You'll come out dollars ahead.



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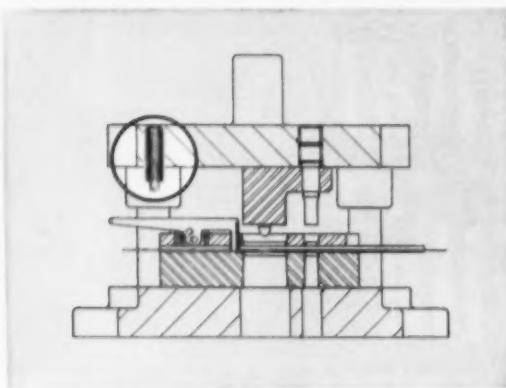


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# Practical Tooling Tips

Number 2 of a series.



**TO STOP SMASHING DIE STOPS**, substitute a Vlier Spring Plunger for the usual square-head screw. The plunger actuates the automatic stop perfectly and, unlike the screw, never needs adjusting no matter how many times the die is resharpened. Available in four models: 50 sizes.

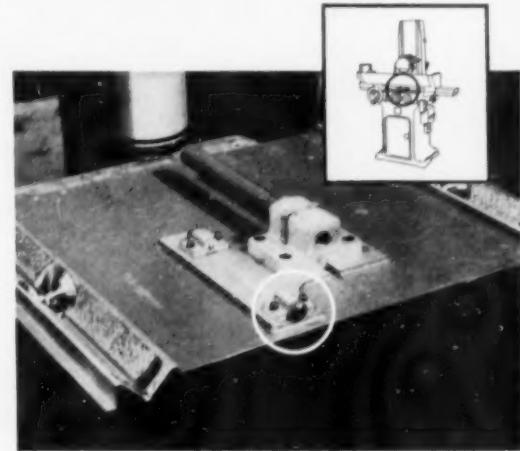


**TO LEVEL MACHINE TOOLS**, electronic racks, benches, etc., use the standard Vlier leveling pad. The pad swivels to  $7\frac{1}{2}^{\circ}$  each side of the center line; adjusts automatically to uneven surfaces. Unique ball-joint design distributes weight over entire pad surface.

New catalog now ready!  
Send for your copy today.



Substituting simple, off-the-shelf Vlier Tooling Accessories for complicated, custom-made devices in both tooling and original equipment applications can result in important savings. Why not put them to work in your plant?



**TO CUSHION SHOCK** as the bed traverses, this surface grinder manufacturer uses two Vlier Spring Stops, reducing wear and tear on the machine. These clever, spring-loaded devices, ordinarily used on fixtures where the absence of side walls prevents the use of spring plungers, are now available in three standard sizes: 3 end pressures. Special sizes made to quantity orders.



**TO GET NEW IDEAS** on how to save with Vlier Tooling Accessories, send for new 28-page booklet "Typical Applications of Vlier Tooling Accessories." It suggests dozens of ways to use these time-savers in both tooling and original equipment applications. Write for your copy today.

Insist on Vlier Tooling Accessories...  
there's still no substitute for quality!



8900 Santa Monica Blvd., Los Angeles 46, California



## Announcing A New Approach to the Solution of Unusual Manufacturing Problems



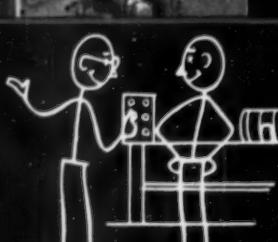
### 1. PROJECT ANALYSIS



### 2. ENGINEERING DESIGN



### 3. EQUIPMENT CONSTRUCTION



### 4. INSTALLATION AND TRAINING

This new four phase process development service, backed up by the know-how and experience of the Cross organization, will get results not available by any other means.

Phase I is a "broad brush" engineering study to determine the economic feasibility of the project. Included in the study are part design analyses, equipment specifications, proposal drawings, and cost estimates.

Phase II comprises the engineering and design of the equipment including assembly and detail drawings, testing procedures, and operating and maintenance instruction manuals.

Phase III covers equipment construction, testing and "de-bugging".

Phase IV includes the installation of the equipment together with the training of the operative and maintenance personnel.

At the completion of each phase, the feasibility of the project is reviewed to see that it is within the specifications and objectives which were established at the outset.

All projects are executed at the new Cross plant — created specifically for the development of automation processes and equipment.

Call us—let's discuss your situation. There is no obligation and the results may surprise you.

Established 1898

THE **CROSS** CO.

*First in Automation*

PARK GROVE STATION • DETROIT 5, MICHIGAN

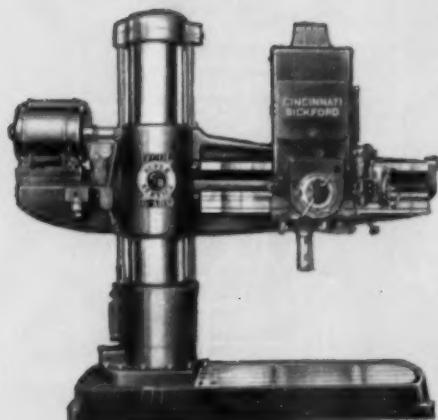
# ALL



# NEW

*Lever  
Shift*

- Exclusive HERRINGBONE drive—the only radial built with this advanced feature.
- Pre-loaded, four-bearing spindle and chromium plated sleeve.
- Hydraulic arm and column clamping, special separate motors and complicated electrical controls are **ELIMINATED!**
- A positive lock-out of the power feed is available. When plunger is operated, it guards against accidental engagement of power feed during tapping or reaming.
- Head-moving handwheel is **DE-CLUTCHED** when head is traversed by power. Possible operator injury is completely eliminated.
- Two sealed-beam work lights, one on each side of spindle, never get hot... impervious to damage from chips and coolant.
- 36 speeds up to 2300 rpm, 18 feeds including 6 geared tap leads.



# CINCINNATI BICKFORD

# Super Service Radials

MODERN DESIGN and latest engineering developments built in the ALL-NEW Super Service Radial drilling machines give you *higher production . . . faster, safer operation . . . and greater machining accuracy*. Here are a few of the reasons why:

Exclusive de-clutchable HERRINGBONE DRIVING GEAR provides the necessary power to drive large diameter drills and heavy cutting tools for maximum penetration. When higher speeds are used, such as for small taps, the herringbone driving gear is de-clutched, eliminating excessive velocity.

Three head designs available—lever shift control of all 36 speeds and 18 power feeds; complete hydraulic pre-selection of speeds and feeds; hydraulic pre-selection of speeds only—manual control of power feeds.

A positive safety device is provided in the head traverse mechanism to guard against damage should the head strike the workpiece or other objects during traverse. This safety functions at any point of head travel on arm. Head-moving HAND-WHEEL DOES NOT REVOLVE when head is being traversed by power.

A pre-loaded, four-bearing, chrome nickel spindle and chromium plated sleeve . . . supported in a honed head bore over 17" long . . . assure maximum spindle rigidity, regardless of position.

The ALL-NEW Super Service Radials are available with 13", 15", 17" and 19" dia. columns, and 4, 5, 6, 7 and 8-ft. arms. For complete specifications on these powerful radial drilling machines, see your nearest Cincinnati Bickford sales representative.



**CINCINNATI BICKFORD DIVISION**  
**GIDDINGS & LEWIS MACHINE TOOL CO.**

CINCINNATI 9, OHIO

Radial Drilling Machines, Upright Drilling and Tapping Machines,  
Upright Gang Drilling Machines, and Precision Production  
Drilling Machines designed for use with spacing table.



For complete specifications concerning Super Service Radials, ask for Bulletin No. R-35.

STARRETT PRECISION MAKES GOOD PRODUCTS BETTER



- New, long 50-division Vernier scales
- Flush fitting Vernier scales eliminate parallax errors
- Inside and outside scales on the same side for easy reading
- Extra long adjusting jaw for perfect squareness — rigid jaw construction
- Master bar hardened and stabilized for maximum rigidity
- Satin Chrome finish — glare-free, rust and stain resistant

### New STARRETT Satin Chrome MASTER-VERNIER CALIPER

for faster, easier, error-proof reading with life-time accuracy

Truly a masterpiece of precision toolmaking, this new Starrett No. 123 MASTER-VERNIER Caliper delivers a lifetime of easier, faster measuring with accuracy that is almost completely error-proof.

Your nearby Industrial Supply Distributor will show you this new MASTER-VERNIER Caliper in 12 and 24-inch sizes . . . also many

other new Starrett tools designed to make accuracy easy. Call him for quality products, dependable service. Or write for big, new Starrett Catalog No. 27 which shows the complete line. Address Dept. E, The L. S. Starrett Company, Athol, Massachusetts, U. S. A.

# Starrett®

PRECISION TOOLS

World's Greatest Toolmakers



PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

**NORTON**

**IS NUMBER**

**IN ABRASIVES**  
*throughout the world!*

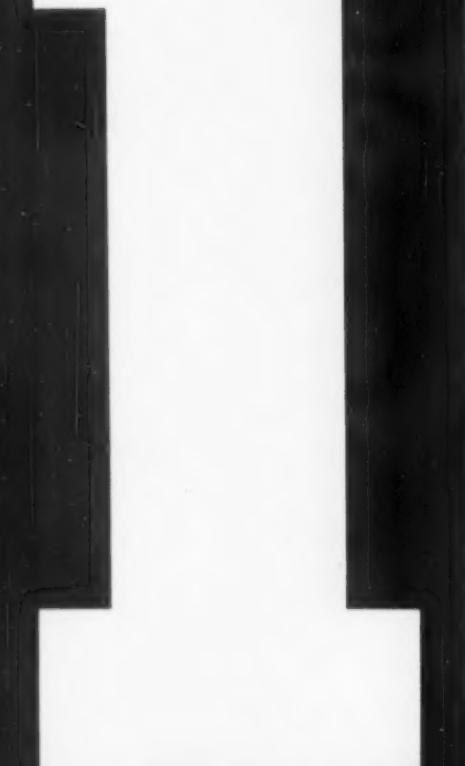
Number **1** in Supplying  
the Abrasives You Need  
for Your Work

*Making better products...  
to make your products better*



# NORTON

## IS NUMBER



**IN ABRASIVES**  
*throughout the world!*

### **In Product Variety**

— a complete line of grinding wheels and abrasives to meet *all* your grinding and finishing requirements.

### **In Engineering Service**

— skilled abrasive engineers the country over to help you solve your grinding and finishing problems.

### **In Customer Service**

— distributor stocks in over 315 cities, large warehouse stocks in five cities, immense factory stocks — all backed by the production facilities of the world's largest grinding wheel plant.

### **In Abrasive Research**

— over 180 scientists and technicians in specialized laboratories using the very latest scientific apparatus developing new and improved abrasives and bonds to cut your grinding costs.

**NORTON COMPANY • WORCESTER, MASS.**

General Offices: Worcester 6, Mass.

Grinding Wheel Plants: Worcester, Mass., and Santa Clara, California

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• Cleveland\* • Detroit\* • St. Louis • Hartford • Los Angeles Area (Huntington Park)

\*Warehouse Facilities and Stocks at this location

Plants and distributors around the world

BEHR-MANNING CO., Troy, N.Y. is a division of Norton Company

# Columbia Tool Steels for 1957-58 with A.I.S.I. Identification and Type Classification of Tool Steels

GRADE	Type	C	Mn	Si	Cr	Ni	V	W	Mo	Co	Cb
<b>COLD WORK TOOL STEELS — OIL HARDENING — TYPE SYMBOL O</b>											
EXLDIE	O1	.90	1.00	—	.50	—	—	.50	—	—	—
GM-02DIE	O2	.90	1.60	—	—	—	—	—	—	—	—
	O7	1.20	—	.75	—	—	—	1.75	—	—	—
<b>MEDIUM ALLOY AIR HARDENING — TYPE SYMBOL A</b>											
E-Z-DIE SMOOTHCUT	A2	1.00	—	—	5.00	—	—	—	1.00	—	—
	A4	1.00	2.00	—	1.00	—	—	—	1.00	—	—
	A5	1.00	3.00	—	1.00	—	—	—	1.00	—	—
	A6	.70	2.00	—	1.00	—	—	—	1.00	—	—
<b>HIGH CARBON-HIGH CHROMIUM — TYPE SYMBOL D</b>											
ATMODYIE	D1	1.00	—	—	12.00	—	—	—	1.00	—	—
ATMODYIE SMOOTHCUT	D2	1.50	—	—	12.00	—	•	—	1.00	—	—
SUPERDIE	D2	1.50	—	—	12.00	—	—	—	1.00	—	—
	D3	2.25	—	—	12.00	—	—	—	—	—	—
	D4	2.25	—	—	12.00	—	—	—	1.00	—	—
	D5	1.50	—	—	12.00	—	—	—	1.00	3.00	—
	D6	2.25	—	1.00	12.00	—	—	1.00	—	—	—
	D7	2.35	—	—	12.00	—	4.00	—	1.00	—	—

<sup>†</sup>With smooth cutting free machining additives      \*Atmodyie and Atmodyie Smoothcut contain approx V.90%.

## COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILLINOIS

CENTRAL OFFICE AND WORKS, CHICAGO HEIGHTS, ILLINOIS — BRANCH STOCKS IN THE FOLLOWING CITIES:

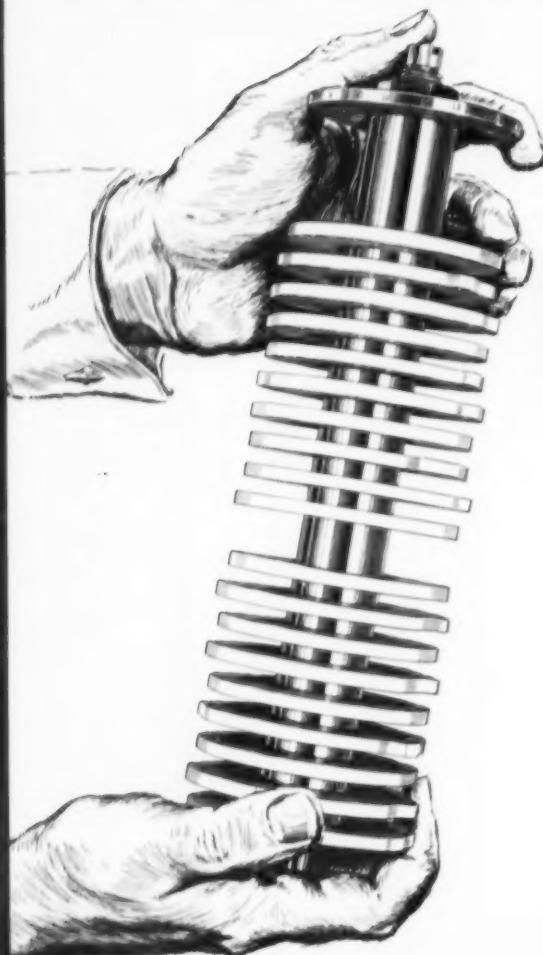
Chicago 30      Cincinnati 25      Cleveland 14      Milwaukee 19      Los Angeles 32      St. Louis 13  
4838 S. Kedzie Ave.      2716 Spring Grove Ave.      1640 St. Clair Ave.      6935 E. Bandini Blvd.      5102 W. Lincoln Ave.  
Phone L.A.yette 3-3632      Phone MULberry 1-8400      Phone M.Ain 1-1785      Phone R.Aymond 3-4684      Phone Lincoln 3-5200

REPRESENTATIVES IN THE FOLLOWING CITIES: Dayton, Erie, Grand Rapids, Hartford, Indianapolis, Louisville, Moline, Newark, Portland and St. Paul



# COLUMBIA TOOL STEELS

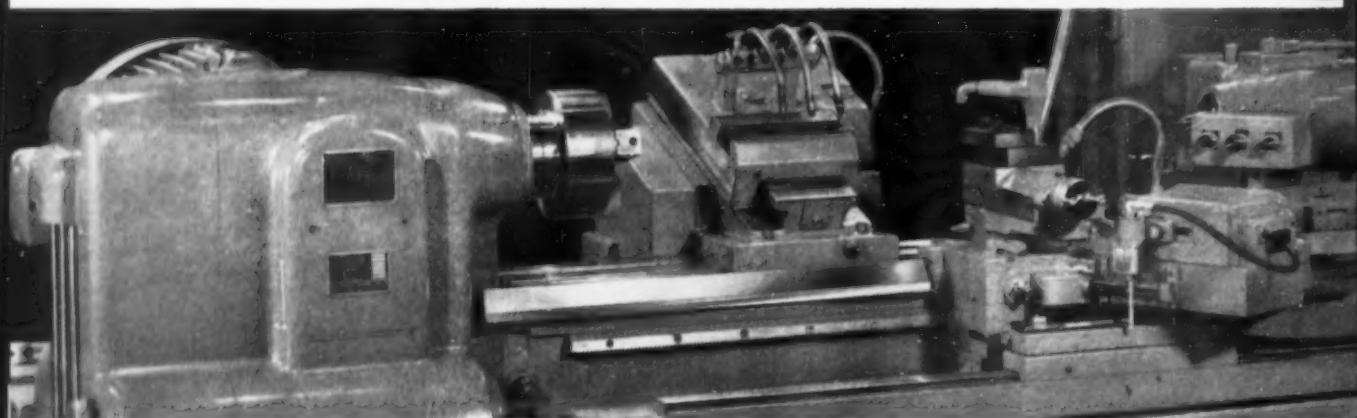
HIGH SPEED STEELS: Clarite — Vanite — Canite — Acmite — Cobite — Maxite — Molite — Molite Smoothcut — Molite Die STEELS: Oildie — Formite No. 3 — Formite No. 2 — Molite HW10 — Vanadium-Fitedie — Buster Alloy — CEC Smoothcut CARBON TOOL STEELS: Columbia Special — Vanadium Extra — Watedie Extra — Columbia Extra — Columbia Standard — Vanadium Standard — Hederdie — Watedie Standard — Columbia Standard — Columbia Electrex



# He's holding

Multi-cycle programmer is the name. And it's only one of many built-in features which make the Monarch Model 21 Mona-Matic the most productive automatic cycle available today.

You can use the Model 21 for a hundred or a million parts. The programmer method cuts setup time to such an extent that switching over from one part to another is accomplished just about as quickly as job change on an engine lathe.



## Flexibility Unlimited

Drive motor may be single speed or two speed. Or inbuilt *constant surface cutting speed* may be provided. This often increases production 30 to 40% on shaft turning, even more on facing cuts and forgings. . . . You can get a two-position tool holder; one position for a roughing cut, the other for a finishing cut. Indexing is automatic as a part of the

cycle. Think what this means in increased production and better tool life. . . . Might chip disposal be a problem? Then a *power chip conveyor* is for you. It removes chips from the machine automatically. . . . Keep chips and coolant under control with a *chip and coolant guard* that functions at will of operator or automatically at proper time during cycle.

# an automatic cycle

The Model 21 has all the power needed to utilize the full productiveness of carbide tooling; has the speed to take advantage of the economies inherent in ceramic tooling.

This machine may be used with equal efficiency on one, two, three or four cut cycle work while the switch from one cycle to another is accomplished in most cases by doing nothing more than changing the multi-cycle programmer and making a few

quick readjustments at the front of the machine.

Get all the benefits of the time-proved "Air-Gage Tracer"—the most accurate lathe duplicating device known, so fast in operation that the only cycle speed limitation is imposed by what the tool will stand.

When you buy a production lathe, RESULTS are what you want. That's what you get in the Model 21. Booklet 1808, yours for the asking, tells why in detail.

**The Monarch Machine Tool Company, Sidney, Ohio.**

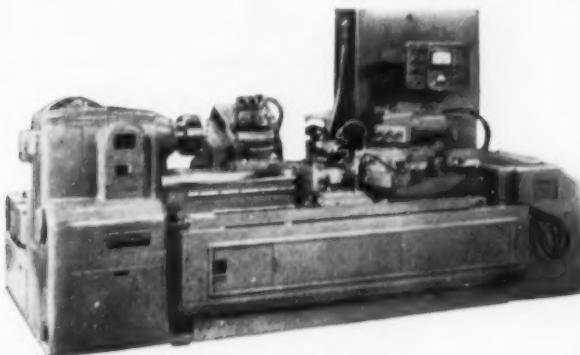
**The above statement that the Model 21 is loaded with production features is not an idle one. Here are some of them.**

- Automatic feed change with up to six different feeds, each of which is infinitely variable and each of which may be made operative at any time during the cycle. This is a Monarch exclusive.
- All feeds adjustable under cut. Such flexibility is desirable on some work where it lengthens tool life and thereby increases day in and day out productiveness.
- "Air-Gage Tracer" utilizes the combination of air-hydraulic control. This accounts for a stylus pressure of only five to six ounces against the template. There is no appreciable template wear; accuracy of template shape reproduction is within  $\pm .001"$  on most jobs.
- All way surfaces flame hardened and ground. Included are bed ways, "Air-Gage Tracer" slide and rear slide way surfaces. The accuracy built in is retained year after year.
- Work piece change speeded by a single lever on tailstock. This is a multiple position lever which in proper sequence controls both the tailstock center and the air operated chuck.
- Rugged rear carriage for auxiliary machining operations, timed to take its cut at any point during the cycle.
- Automatic lubrication; from end to end, all the time.

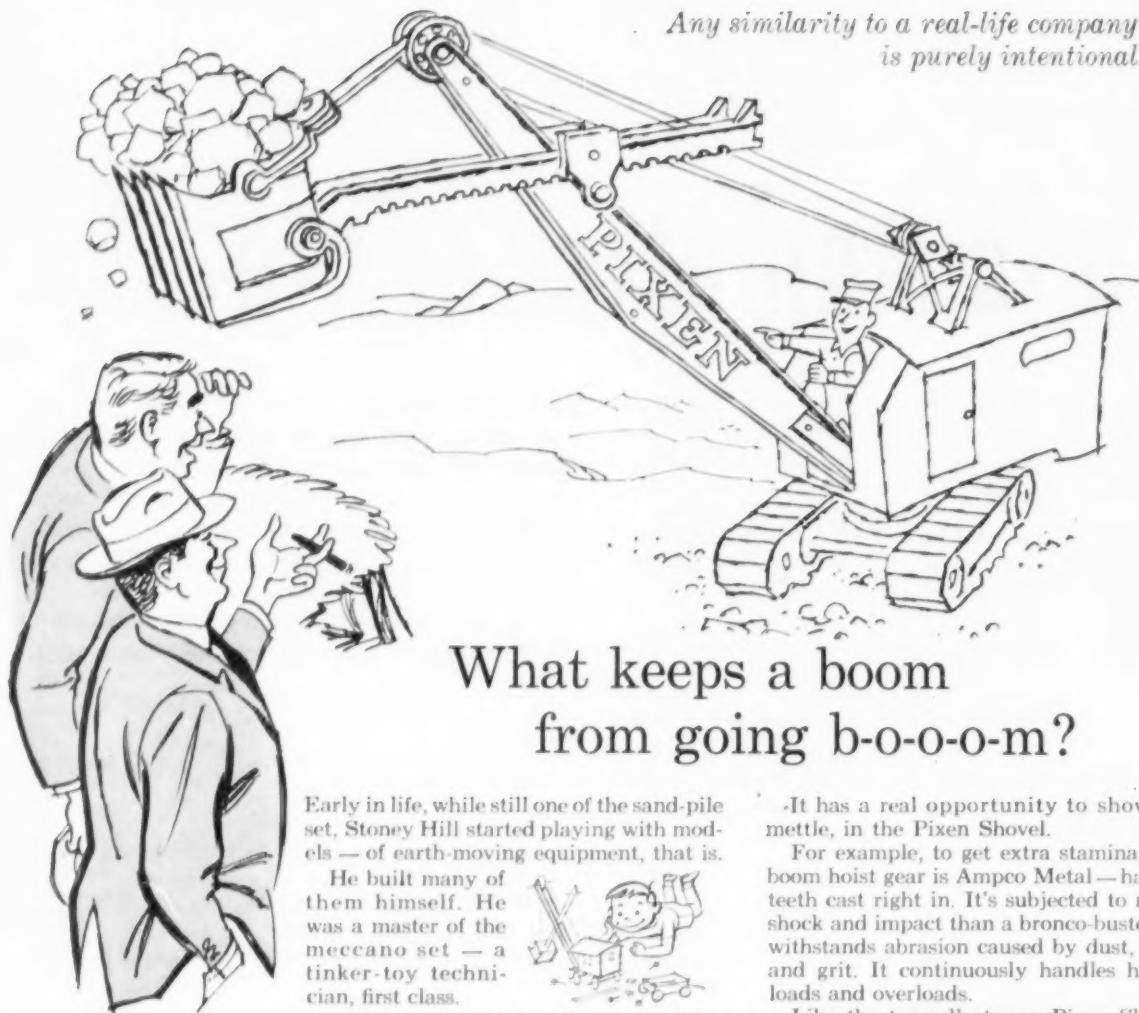


**Monarch**  
TURNING MACHINES

FOR A BETTER TURN FASTER . . . TURN TO MONARCH



*Any similarity to a real-life company  
is purely intentional*



## What keeps a boom from going b-o-o-o-m?

Early in life, while still one of the sand-pile set, Stoney Hill started playing with models — of earth-moving equipment, that is.

He built many of them himself. He was a master of the meccano set — a tinker-toy technician, first class.

"A born mechanic," folks said. A born manufacturer, he turned out to be.

Today, he builds earth-moving equipment for real — shovels, draglines, backhoes, bulldozers, scrapers. You want to move a mountain, you talk to Stoney Hill.

And his best mountain-mover is the Pixen Shovel. What a brute! An ordinary hill is little more than a mouthful to that baby. It can level anything in sight.



It can bang against boulders. Sink into sand. Maneuver in mud. Make like a mountain goat on some pretty steep grades. And still come back for more, day in, day out.

Stoney designed it that way. One thing he insisted on was that critical parts be made out of Ampco Metal. As you know (we hope), Ampco Metal is a whole series of copper-base alloys specially engineered to resist all forms of wear and corrosion.

It has a real opportunity to show its mettle, in the Pixen Shovel.

For example, to get extra stamina, the boom hoist gear is Ampco Metal — has its teeth cast right in. It's subjected to more shock and impact than a bronco-buster. It withstands abrasion caused by dust, dirt, and grit. It continuously handles heavy loads and overloads.

Like the tax-collector, a Pixen Shovel gets anywhere there's paydirt. Track-roller bushings cast of Ampco Metal help minimize breakdowns and replacements due to friction, shock, and abrasion.

Just to make sure the Pixen Shovel doesn't "blow its top" when it gets all shook up, Stoney has attached the cab to the frame with a king-pin bushing of Ampco Metal. The turn-table roller bushing is Ampco Metal, also. And so are the saddle plates. No use taking chances.

Perhaps *your* bread and butter is screw machines, not shovels. Whatever it is — if wear (or corrosion) is a problem, ask an Ampco field engineer to help you dig up a solution.

And write today for Bulletin 33 for more facts on "the metal without an equal." *Ampco Metal, Inc., Dept. TE-11, Milwaukee 46, Wisconsin. (West Coast Plant: Burbank, California).*



**AMPCO® METAL**  
*The metal without an equal*

# CLECO

## MULTIPLE SPINDLE UNITS

.....*for modern assembly lines*

✓ **reduce costs**

If "one-at-a-time" rundown of nuts and bolts on your assembly line results in labor costs higher than you like to think about . . .

If your production schedules would benefit from increased speed and efficiency in multiple nut setting, bolt tightening, or similar operations . . .

If your product needs the quality control afforded by the simultaneous application of uniform torque to all nuts or bolts . . .

Why not call on Cleco, pioneer developers of modern, pneumatically powered multiple spindle assembly equipment?

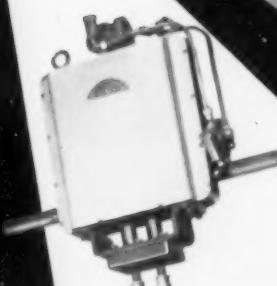
Cleco will custom engineer a multiple spindle unit for your specific application, whether you require a manually-controlled, semi-automatic, or automatic machine—whether your operation calls for 2 driving spindles or 24, or more.

Motor arrangement patterns are practically unlimited. The use of standard, proven Cleco Air Motors assures uniform operating efficiency, low maintenance costs, and immediate parts availability.

Illustrated are a few examples of the many custom-designed multiples Cleco has delivered. To get detailed information about what Cleco can do to speed production, improve quality control, and cut down costs for you, write Cleco Air Tools, P. O. Box 2119, Houston.

✓ **facilitate quality control**

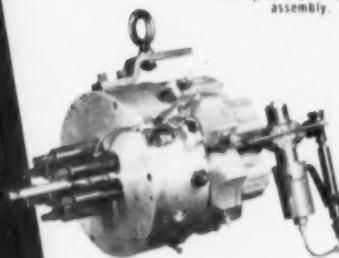
✓ **speed production**



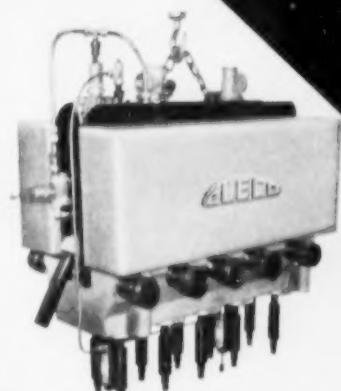
Two spindle nutsetter for automobile stabilizer bracket assembly.



Five spindle unit for wheel assembly.



Six spindle nutsetter for assembly of flywheel to crankshaft. Close center distance made possible by driving spindles through offset gears. Unit has stripping rod for easy disengagement from the work.



Ten spindle unit for installation of V-8 engine main bearing caps. Has air regulators mounted in manifold, stripping rod for disengagement.

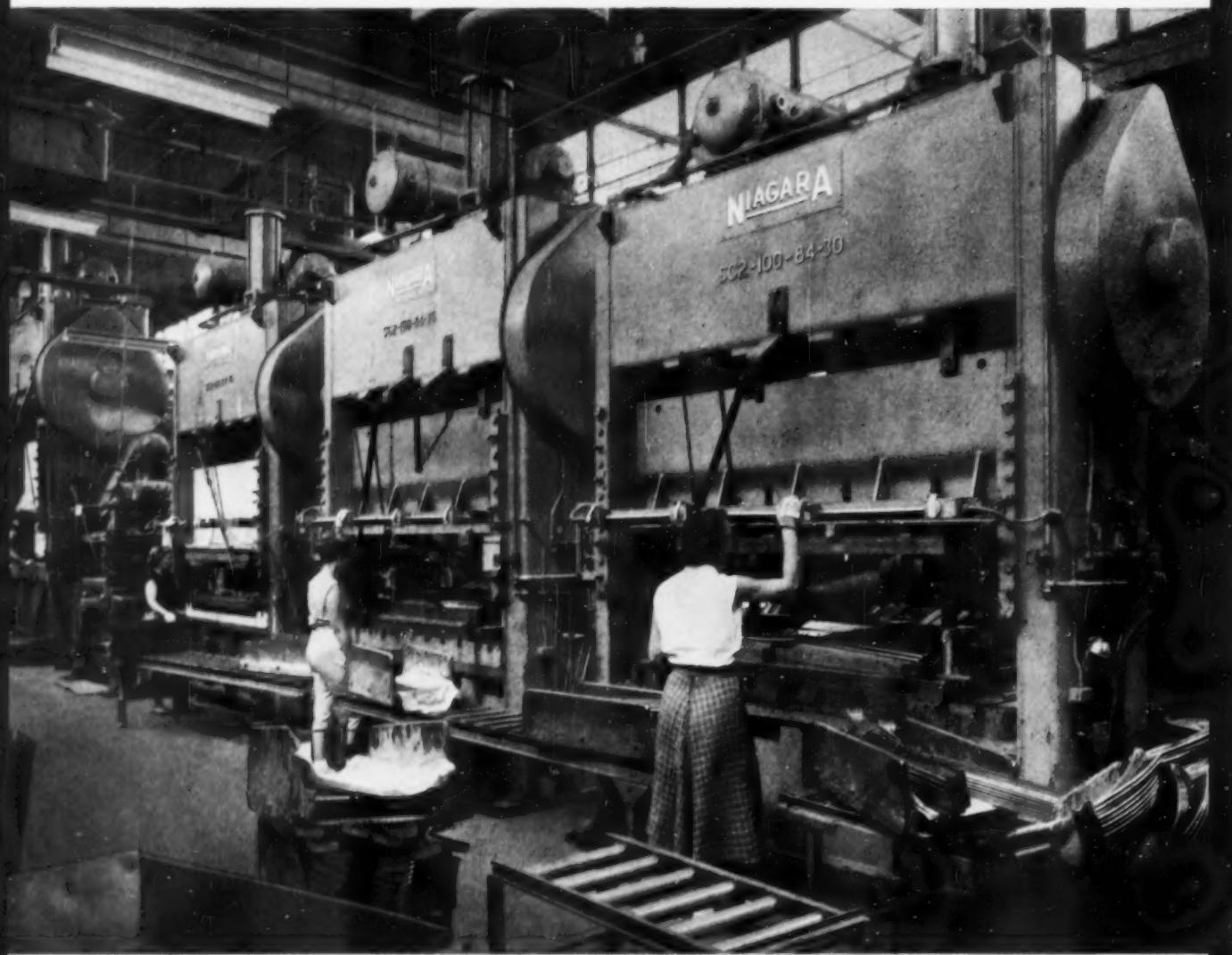


Twenty-four spindle machine shown setting oil pan bolts on V-8 automobile engine. Has stripping rods for disengagement.

**CLECO**  
AIR TOOLS

Division of Reed Roller Bit Company  
HOUSTON

"we concentrate on Niagara



NIAGARA

DOUBLE CRANK STRAIGHT

*America's most complete line of presses, press brakes, shears, other machines and tools for plate and sheet metal work*



# presses...

## ...they require a minimum of maintenance"

In-line operation of four Niagara Series SC-2 Presses, engaged in progressive production of automotive side moldings from .025" #430 stainless steel.

Press operator shows a blank and formed molding which will grace one of the "Big Three" cars.



### SIDE PRESSES

Producing up to 1,750,000 automotive moldings per month, these four Niagara Double Crank Straight Side Presses do the work of eight for a large Midwestern metal stamping firm. Their long beds enable the outfitting of each press with two sets of dies for two separate operations.

"We believe in standardizing. That is why we concentrate on Niagara Presses. They require a minimum of maintenance. When jobs come in, we are sure we can get them out. They are a volume machine," says the vice president and plant superintendent.

... and with good reasons, this famed line of Niagara presses requires a minimum of maintenance:

- *Rugged, integral, all-welded steel frames of exclusive triple box section design properly resist deflection to assure greater accuracy and longer die life.*
- *Laminated non-metallic ways of box type welded steel slides are a positive safeguard against scoring and assure trouble-free service.*
- *Low inertia pneumatic friction clutch reduces beat and wear. Only the shaft and driving plate are started and stopped at each cycle. Most of the clutch weight continues to rotate with the flywheel.*
- *Outboard mounting of clutch makes it accessible for easy maintenance . . . without disturbing any drive or crown parts.*
- *No adjustment for wear of clutch plate is necessary. It is self-compensating.*
- *Clutch linings are cycle-welded to plate, without rivets, increasing effective life.*
- *Brake shoes are full floating and self-aligning . . . cannot cock, bind or wear unevenly.*
- *Steel gears run in totally enclosed oil baths. Centralized pressure lubrication sends vital oil to journals, ways and wherever necessary for long efficient, service life.*

Like this well known metal fabricator, it will be profitable for you, also, to consider standardizing on Niagara presses. First of all, Niagara has the most to offer . . . straight side double crank, single crank and eccentric geared, open back inclinables and dozens of others. Secondly, in the words of the same company's purchasing agent: "The prices on Niagara Presses are right . . . and they do the job."

Built in 50 through 400-ton capacities, Niagara Double Crank Straight Side Presses are readily equipped with automatic feeds, variable speed drives, iron hands and other automatic materials handling devices so popular with the automotive and appliance industries. Post yourself on this important line by requesting Bulletin 64.



NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

DISTRICT OFFICES:

Buffalo • Cleveland • Detroit • Indianapolis • New York • Philadelphia

Distributors in principal U. S. cities and major foreign countries

# Magnamatics



# reduce cabinet breakage 70% at Motorola

**The Problem:** Motorola's assembly line in Quincy, Illinois experienced difficulty fastening chassis and fibre backing to plastic radio cabinets. Time was lost repairing cabinets broken by over-tightened screws . . . profits were reduced by discarded cabinets.

**The Solution:** Thirteen CP "Magnamatic" One Shot Air Screwdrivers replaced previous tools that did not provide sufficient quality control.

**The Result:** CP "Magnamatics" have been on the job for over eighteen months. Rejects have dropped 70 to 80 percent. The CP "Magnamatic" One-Shot clutch—runs nuts or screws to precise, pre-set torque—prevents over-tightening, makes it almost impossible to crack plastic cabinets or strip screw threads—doesn't ratchet, eliminates surface damage to lustrous plastic finishes. And more! Bonus benefits of "Magnamatics" include: a new low in maintenance costs (averages only 11¢ per tool per month), quiet operation and no cost or time lost due to bit breakage.

**Capacities: #4 screws to 3/8" bolts. Reversible and non-reversible types.**



## Chicago Pneumatic

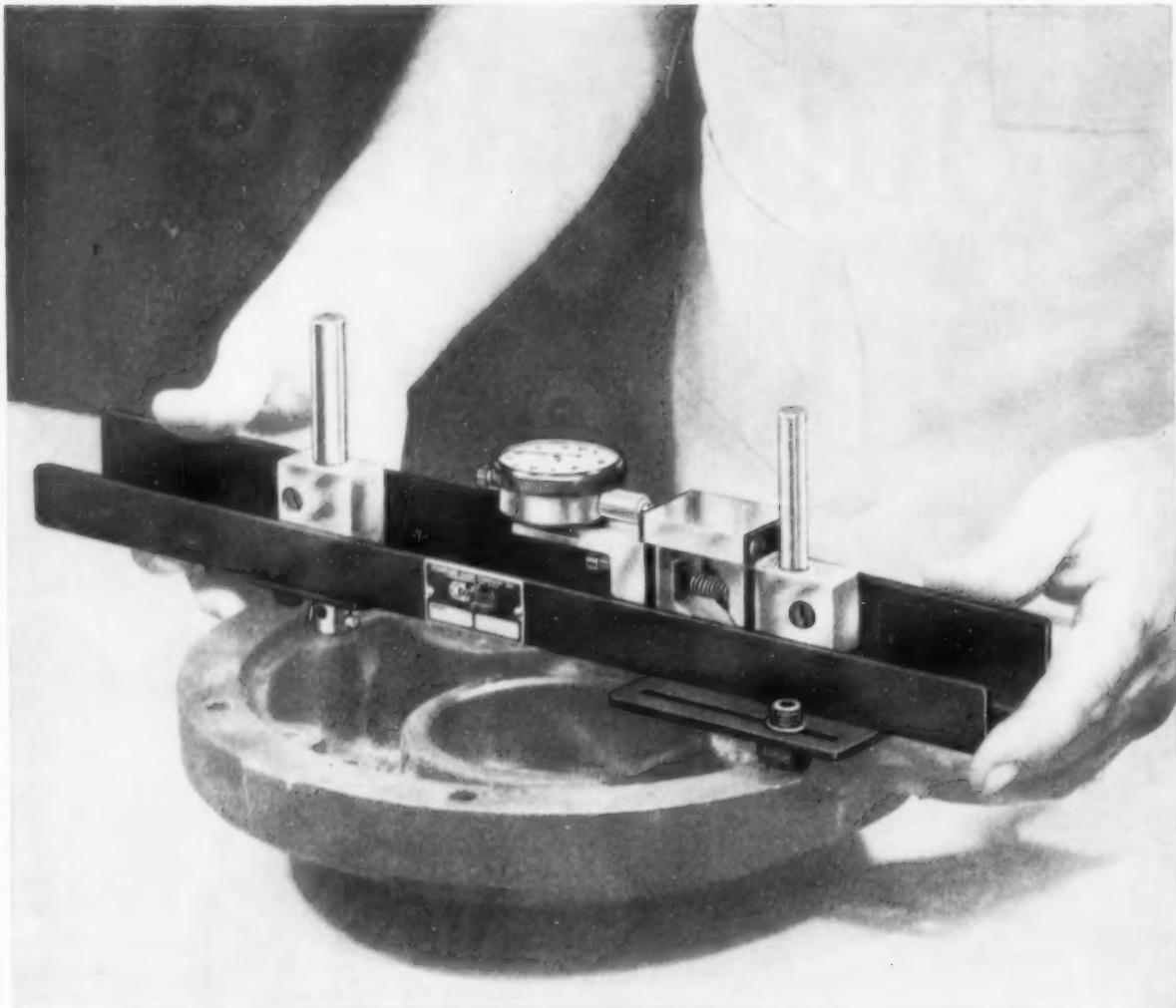
8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES  
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



- Chicago Pneumatic Tool Company, Dept. M-75  
8 East 44th Street, New York 17, N. Y.
- Please arrange demonstration. No obligation, of course!
- Please send me FREE booklet SP-3165  
"Magnamatic Case Histories"
- Please send me FREE Bulletin 580 on  
"Magnamatic" units for multiple applications.

Name \_\_\_\_\_  
Company \_\_\_\_\_  
Address \_\_\_\_\_  
City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



## NOW! *Adjustable* Shallow Diameter Gages LOWEST PRICE...“Tenth” Accuracy

This new, multi-purpose, multi-range series by **STANDARD** obsoletes the need for expensive, specially designed shallow diameter gages. New type reed-linkage insures positive, accurate transfer of movement from contact point to indicator.

Gages are easily set to regular adjustable masters or with gage blocks and parallels. Tail and head assemblies are interchangeable between frames of

different lengths. Smallest size permits checking I.D.'s or O.D.'s down to 4" and depth adjustment permits easy measurement from 0" to 2" below supporting plane. Greater depth ranges if needed.

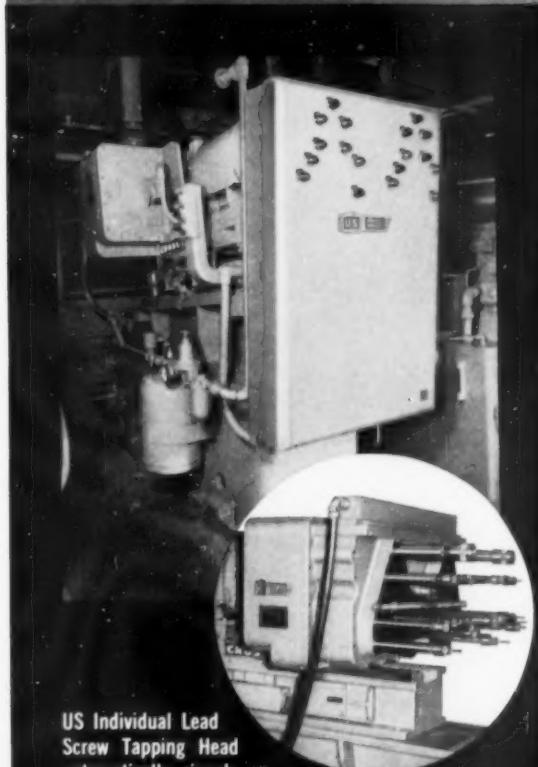
All this at *lowest price*. So, if your production includes any problems of shallow diameter gaging be sure to ask the *Man from Standard*. Or, write us right here at the plant.

**STANDARD GAGE COMPANY, INC.**  
POUGHKEEPSIE, N.Y.  
SINCE 1925

A COMPLETE LINE OF GAGES . . . INDICATING, FIXED AND ADJUSTABLE TYPES



U. S. NAVY PHOTO



US Individual Lead  
Screw Tapping Head  
automatically signals on

a light panel exact location of any spindle not tapping to full depth, and stops the entire line. In addition, patented US Safety Tap Spindles prevent all tap breakage due to dull taps or improperly drilled holes. Installed on transfer machines, this exclusive US development provides dual automatic protection during tapping without need for an extra probing station.

## Trouble Spotter...

This majestic cruiser is a U. S. Navy airship. Its mission is locating trouble—*ahead of time*. How effective its deadly purpose in convoy is attested by the fact that “no vessel escorted by a blimp in World War II was sunk by an enemy submarine.” Its invaluable contribution to our Aircraft Early Warning system is also firmly established. It is a Navy “tool” that virtually eliminates surprise.

The U. S. Drill Head Co.’s new electronic device seeks trouble too—in automated production lines. It locates faulty machining during a “transfer setup” and stops the machine *before* succeeding operations are begun. It minimizes the chance of costly smash-ups and resulting expensive down-time . . . reduces re-operating and scrap-loss costs.

This development is another precision cost-reducing “tool” from the largest exclusive drill head builder in the world.

We manufacture all types of adjustable, fixed center and individual lead screw tapping heads. Ask us to help solve your multiple drilling and tapping problems.



DRILL  
HEAD

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

2  
**Firth Sterling**  
 MECHANICAL  
 TOOLHOLDERS

for the most  
 economical Tooling  
 combination  
 you've ever used!

With these two Firthite Mechanical Toolholders and Firthite Carbide throw away Inserts you can handle almost any turning, facing and chamfering operation at lower tool cost and with less downtime for tool maintenance and resetting. *Mechanidex* for heavy duty, high production jobs; *Thriftool* for lighter ones. Use these two and save time and money!

**FIRTHITE MECHANIDEX**

- Mechanidex toolholders feature one-piece adjustable chipbreaker clamp, eliminating loose parts when indexing.
- Carbide tipped or high speed steel chipbreaker clamps optional.
- Clamp screw nut eliminates heat-seized clamp screws, permitting easier insert indexing and replacement.
- Available in 4 styles Right or Left hand in shank sizes ranging from  $\frac{3}{4}$ " sq. to  $1\frac{1}{4}$ " sq. (Can use complete line of standard throw away inserts.)
- Negative rake design permits use of triangular and square inserts with 6 or 8 cutting edges, depending on toolholder style.



**Firth Sterling**

—INC—

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

MILLS: MCKEESPORT, TRAFFORD, DETROIT, HOUSTON, HARTFORD

OFFICES AND WAREHOUSES\*: BIRMINGHAM CHICAGO\* CLEVELAND\* DAYTON DETROIT\* HARTFORD\* HOUSTON\* LOS ANGELES\* PITTSBURGH WESTFIELD, N.J.

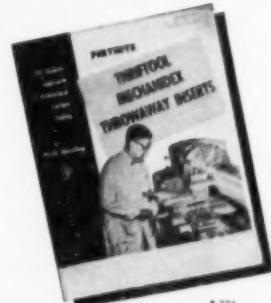
**FIRTHITE THRIITOOL**

- Triangular throw away inserts with 6 cutting edges . . . no grinding, use each cutting edge once then throw away.
- Outlasts single point brazed tools.
- Lowest cost mechanical toolholder; fewest component parts. (Chipbreakers optional.)
- Toolholder parts interchangeable — reduces inventory and handling costs.
- Precision anvil assures proper insert positioning. ( $\frac{3}{4}$ " square shanks and above.)



*Write to:*

200 Firth Sterling Building, 3113 Forbes St.,  
 Pittsburgh 30, Pa. for your free copy of  
 Catalog MTI-3, "The Modern Approach to  
 Economical Carbide Tooling."



**PRODUCTS OF FIRTH STERLING METALLURGY**

High Speed Steels  
 Tool and Die Steels  
 Stainless Specialties  
 High Temperature Alloys



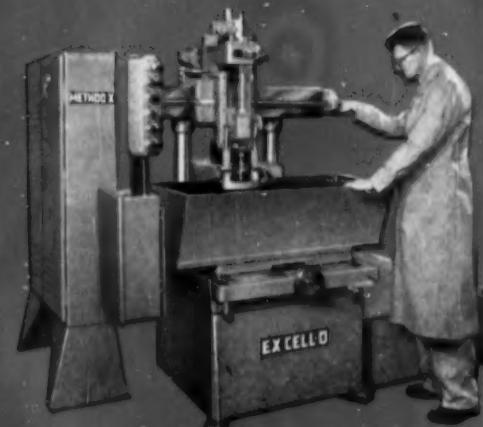
Sintered Tungsten Carbides  
 Firth Heavy Metal  
 Chromium Carbides  
 High Temperature Cerments

Zirconium



**XLO**  
EX-CELL-O FOR PRECISION

Cut intricate shapes of sintered carbides and super alloys with Method X.



Ex-Cell-O Method X Standard Vertical Electro-spark Machine.

## Electrospark machining really cuts costs

57-39

Doubt it? Here's what you can do. With an Ex-Cell-O Method X Machine, sintered carbides and super alloys can be quickly and easily cut off, pierced, slotted, formed, trepanned, drilled and tapped, often in shapes (above) no other machine tool can duplicate.

What's more, because Method X can readily machine toughest metals, many shops find it pays for itself as a scrap-saver alone. With Method X, other machines' mistakes can be corrected, even after hardening.

Why not check today on the very real cost-

cutting opportunities Method X may offer in your own manufacturing operation? Simply contact Ex-Cell-O, Detroit.

**EX-CELL-O**  
CORPORATION  
DETROIT 32, MICHIGAN

Machinery  
Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



*Versatile*  
**WIEDEMANN TOOLING**  
*Saves You Money*

6 typical jobs—total cost of tools shown . . . \$194.80!  
 That's just the first of many cost-saving advantages of piercing short run jobs with a Wiedemann Turret Punch Press.

Hundreds of Wiedemann users report 60% to 90% direct savings in production of chassis, panels, side rails, etc.—and engineering changes are reduced to a matter of minutes.

Wiedemann Turret Punch Presses require only one punch and die of a size . . . rounds, squares, louvers, groups, extrusions . . . from 0.093" dia. to 7" square and each is ready for use . . . larger openings and notches are produced easily with a series of "hits". Here is real low-cost tooling flexibility.

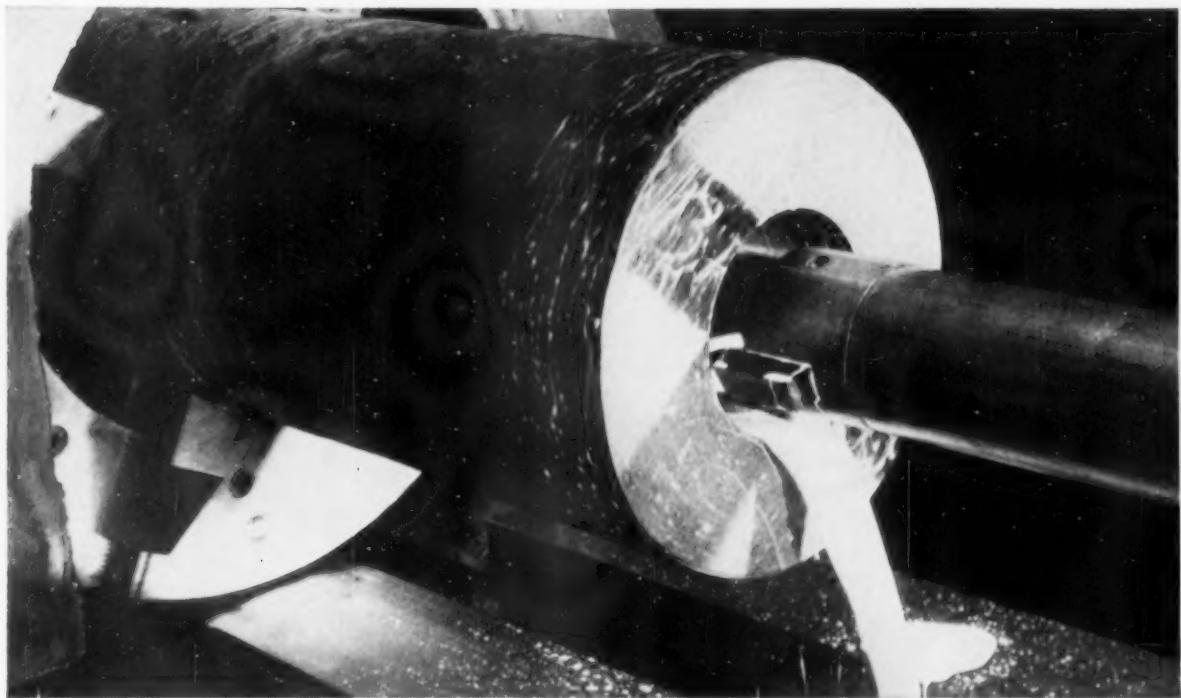
Why not prove to yourself how much more you could produce for *less* with a Wiedemann. We'll be glad to make a time study of your work. Just send prints and ask for Bulletin 201.

**There's a Wiedemann  
 for every short run piercing requirement.**

RA-41P Wiedemann  
 15-ton capacity  
 28" throat depth  
 Other presses from 4 to 150 tons

**WIEDEMANN  
 MACHINE COMPANY**

4245 Wissahickon Ave. • Philadelphia 32, Pa.



## Finish boring is your first step with Timken® seamless steel tubing —the hole's already there!

YOU save time and money when you make hollow parts with Timken® seamless steel tubing instead of bar stock. You eliminate drilling because the hole's already there. Finish boring is your first production step. With less metal to machine away you get more parts per ton of steel.

And because Timken seamless steel tubing eliminates one boring operation, your screw machine stations are free for other jobs. You get more machining capacity without adding machines.

And you get a better quality finished product with Timken seamless steel tubing because of the way we

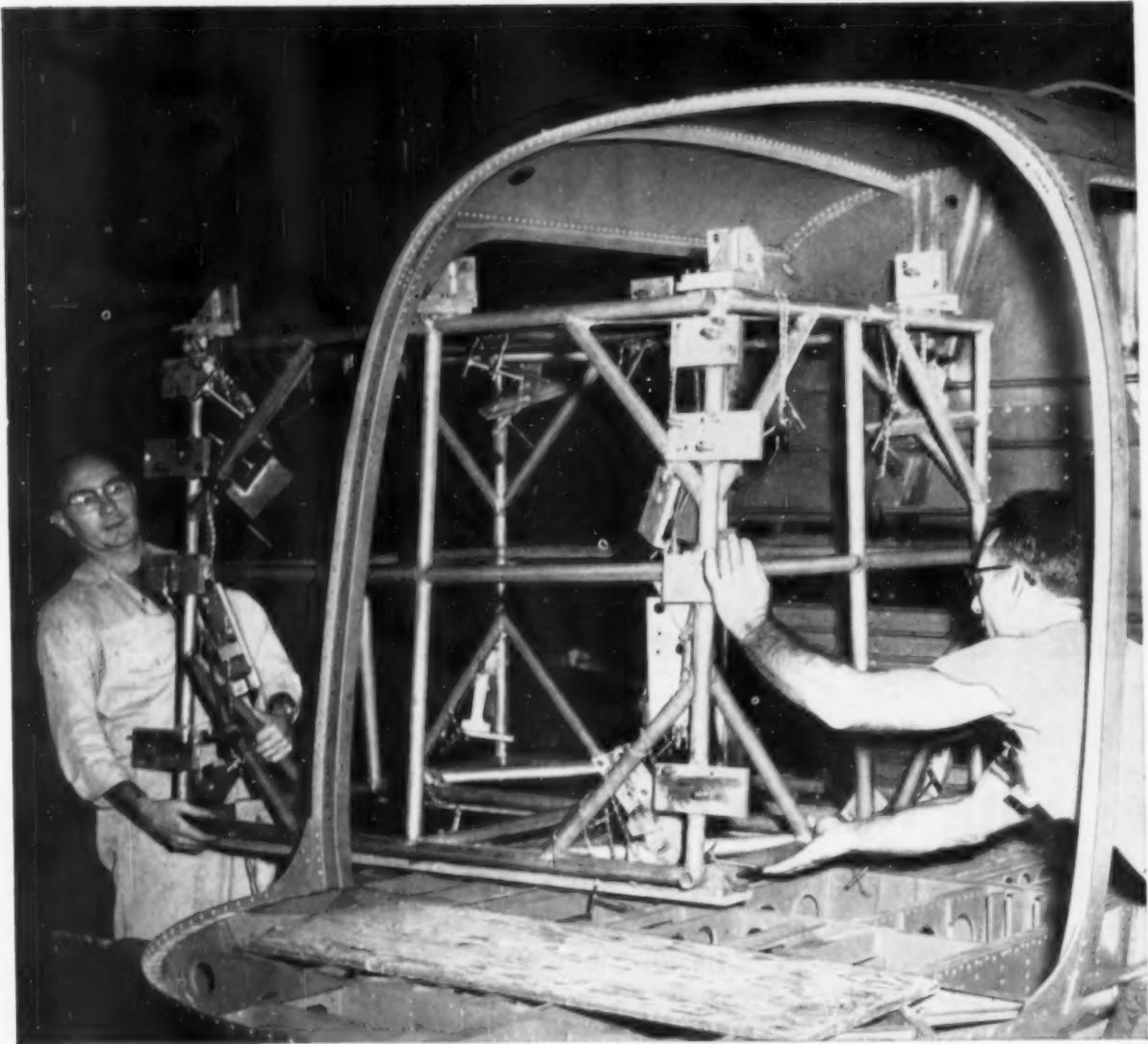
make it. A solid round is forged over a mandrel, thoroughly working the metal inside and out. This rotary piercing operation gives Timken seamless steel tubing its fine forged quality, uniform spiral grain flow. With exacting control of temperature and piercing speed, we maintain this quality from tube to tube, heat to heat, order to order.

And to further increase your steel savings, Timken Company engineers will be glad to recommend the most economical tube size for your hollow parts job. You'll get a size guaranteed to clean up to your dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO".

**TIMKEN** TRADE MARK REG. U. S. PAT. OFF. **STEEL**  
*Fine Alloy*

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

See the next Timken Television hour, "The Innocent Years" over NBC-TV, Thursday night, November 21st.



TWO MEN can easily maneuver this lightweight magnesium tool out of the cabin.

## "Light magnesium tool helps precision-build Bell 'copters"

"Various parts and sub-assemblies of a helicopter cabin must be precision located in order to achieve accurate assembly results," says Mr. C. D. Riley, supervisor of standards in tool design, Bell Aircraft Corporation.

"To assure accuracy, we use a supporting tool frame to hold the various parts in position while being joined. So we built the supporting frame of magnesium. Weighing only 112.5 lbs., it meets our every requirement for accuracy.

"A steel or aluminum frame weighing as much as 300 or 400 lbs. would deflect the floor of the cabin beyond the allowable limits of plus or minus .010 inch at critical attach points resulting in poor fitting of doors, plexiglas bubble and other components." For information on weight-saving, readily welded magnesium tooling plate and extrusions, contact your nearest supplier of Dow Magnesium, or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. MA-1415U-3.

**AVAILABLE FROM STOCK AT:** Copper and Brass Sales, Inc., Detroit, Michigan • Fullerton Steel and Wire Co., Chicago, Ill.  
Hubbell Metals Inc., St. Louis, Mo. • A. R. Purdy Co., Inc., Lyndhurst, N. J. • Reliance Magnesium Co., Los Angeles, Calif.  
Vinson Steel and Aluminum Co., Dallas, Texas.

YOU CAN DEPEND ON



It isn't easy . . . the job of knowing exactly the right way to apply heat in the making of your product. That's what we're here for, to give you the right answers. Stay with us for five minutes and four pages and we'll give you an idea how Lindberg's answers can ease your job.

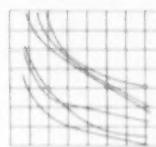


Applying heat to industry has been Lindberg's business for many years. But the way we've gone about our business is what's most important to you. First of all, Lindberg covers all phases of "heat for industry" in a much broader way than anyone we know in the field. So we can recommend just the right equipment, the correct techniques best suited to your individual requirements and your production methods. It's pretty significant, too, that over the years Lindberg has come up with many of the most vital improvements in the industry, frequently as an answer to customer needs for faster, more efficient, more economical methods.

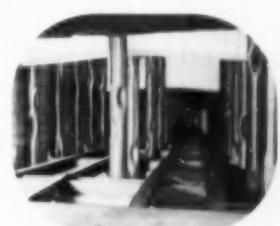


We've kept ahead of the field because here at Lindberg we have been able to put together an exceptional creative staff of metallurgists, research technicians and engineers, the best in the business, we vow. Also, through our world-wide organization, with plants and subsidiary companies in many countries, we are always abreast of the latest industrial developments anywhere.

Here are a few examples of Lindberg innovations. Years ago Lindberg engineers pioneered and developed the famous Cyclone furnace, applying the first 100% forced convection heating principle for accurate, low cost tempering. This was followed by the introduction of the world's first high temperature (2200° F.) endothermic generator and the raising of 100% high speed convection heating into the high temperature field.



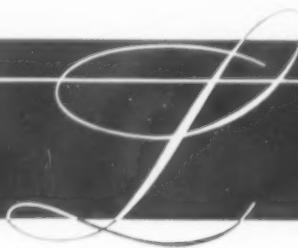
Modern heat treating methods owe much to Lindberg, what with the development of controlled atmosphere generators, the creation of dew point equilibrium curves to establish proper atmosphere values for type of steel and temperatures involved and the exclusive Lindberg Carbotrol to maintain these values automatically. For fuel-fired atmosphere furnaces we also perfected the "dimple" vertical radiant tube, a big step toward better furnace design. Provides more efficient heat application in more compact, less space-consuming furnaces. Portable, replaceable in a few minutes, this tube operates at maximum efficiency longer.



*Lindberg Engineering Company*

2450 WEST HUBBARD STREET • CHICAGO 12

Scratch a new industrial heating idea and you'll find "Lindberg" every time. Our research and development engineers and technicians won't have it any other way. That's why they consistently come up with newer and better ways of making heat work for you in your industry, bless 'em.

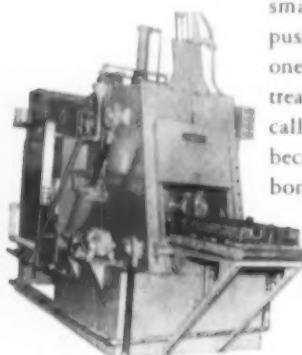


You've probably heard a lot about Lindberg's wonderful new CORRTHERM electric heating element lately. It's quite a thing! It makes carbonitriding and carburizing with electricity practical, efficient and economical. CORRTHERM elements operate at extremely low voltage, eliminating leakage through carbon saturation, previously such a problem in electric atmosphere furnaces. With superlative heating units for either electric or fuel-fired furnaces you can be sure that Lindberg need play no favorite when recommending the equipment most practical, most efficient and most economical for your job.



Our name is synonymous with carbonitriding and carburizing furnaces. We've built thousands of them, from

small jobs up to big three-row pusher automatics. At the left is one of the most widely used heat treating furnaces in the world. We call it Lindberg's "Five-in-one" because it's ideal for five jobs, carbonitriding, carburizing, annealing, hardening and carbon restoration. Our Heat Treating Furnace Division has the experience, the knowledge and the courage to engineer and build furnaces to meet the precision require-



ments of any heat treating operation. We build them for carbonitriding, carburizing, hardening, tempering, normalizing, bright stainless annealing, brazing, carbon correction, nitriding, sintering, or what need you. Atmosphere generators, too, all types of them to take care of any heat treating operation requiring a protective atmosphere.

For research use Lindberg makes a broad line of heating equipment scientifically designed for maximum control and dependable operation, everything from simple hot

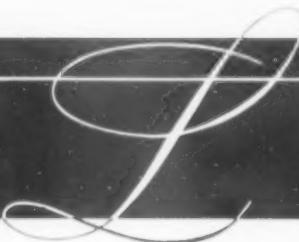


plates to small heat treating furnaces actually usable for minor production jobs. An unusual Lindberg development for laboratory use is a High Frequency unit for carbon and sulfur determination.

New at Lindberg is a line of larger-than-lab, smaller-than-standard equipment designed specifically for pilot plant use. You can test your materials, your methods, on equipment moderately priced but production capable. Fuel-fired, electric and High Frequency units are included. At the right is an electric vacuum-type furnace ideal for testing this newest and most promising heat treating method. For complete details write our Pilot Plant Equipment Division.

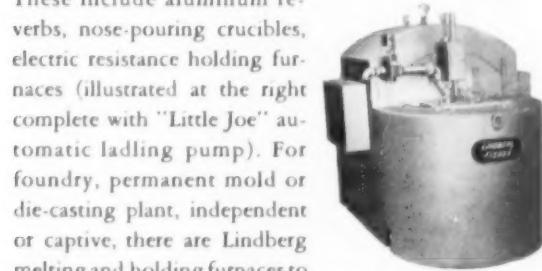


From a laboratory furnace no bigger than a breadbox to a car bottom furnace as big as a six-room house, there's no limit to what Lindberg can make heat do for you. Whatever product you make, if heat will make it better, there's a Lindberg furnace that's sure to do the job better.



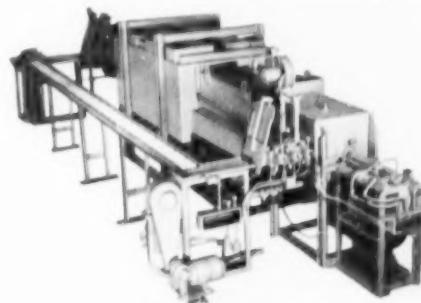
**H**eat and aluminum have been Lindberg's twin babies for years. Our research and engineering staff has made a lot of innovations in this field, too, starting with the now famous two-chamber induction melting furnace introduced more than ten years ago. Most recent development is the Autoladle (we call it "Little Joe"), the first practical automatic aluminum ladling unit yet devised. Used with Lindberg melting and holding furnaces "Little Joe" makes automatic casting of aluminum fast, dependable and economical.

Lindberg's Melting Furnace Division makes a wide variety of melting and holding furnaces for aluminum, brass, bronze, tin, zinc, lead and other non-ferrous metals. These include aluminum reverbs, nose-pouring crucibles, electric resistance holding furnaces (illustrated at the right complete with "Little Joe" automatic ladling pump). For foundry, permanent mold or die-casting plant, independent or captive, there are Lindberg melting and holding furnaces to fit your requirements. If your problem in this field needs a special solution Lindberg's design staff can find it.



Suppose your industrial heating operation has to do with ceramics. We also offer you superior equipment for every ceramic application. Lindberg's long experience in applying heat and atmospheres to metals has been a natural background for the development of ceramic kilns for all purposes. Our Ceramic

Kiln Division provides all types of kilns, big ones, small ones, electric or fuel-fired, standard or special, for electrical ceramics, abrasives, refractories, ferrites, sintering and

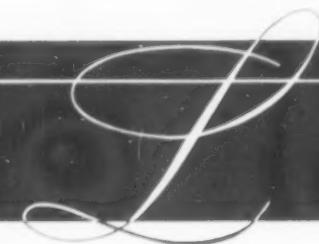


calcining, structural clay products and white ware. Shown above is an entirely new type of kiln, developed for the special requirements of electrical ceramics. It is completely automatic, atmosphere controlled with five zones of control for flexibility. In ceramics, too, our designers and engineers welcome the opportunity to develop special equipment to fit your special product requirement.

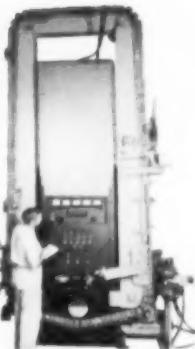


**LINDBERG**  **heat for industry**

Keep cool about your industrial heating problems. Get in touch with us, one way or another, and we'll give you the right answer in a hurry. There's a Lindberg representative in every major industrial city. Call, write, wire or send a boy to Lindberg. We'll send you a man.



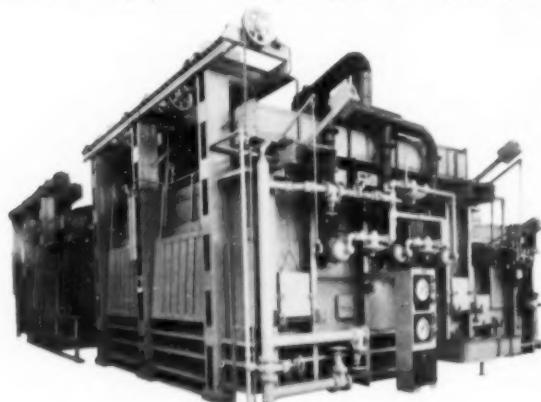
To round out the full measure of its service to "heat for industry" Lindberg is one of the largest makers of High Frequency heating units. Our "H-F" designers and engineers have made outstanding developments in this important heat treating field. For example, at the right is a remarkable unit just recently completed for aluminizing automotive valves. It was designed vertically, saving 60% of floor space, and is completely automatic. No operator is required. It fits perfectly into an automated production line.



Our High Frequency Division provides units for hardening, brazing, soldering, annealing and many other processes and designs a variety of fixtures for application to "H-F" units. Lindberg also supplies a complete line of motor generators for all induction heating and melting applications. This equipment is available for M-G set frequencies of 1 KC., 3 KC. and 10 KC. and in power outputs from 30 KW. to 1250 KW.



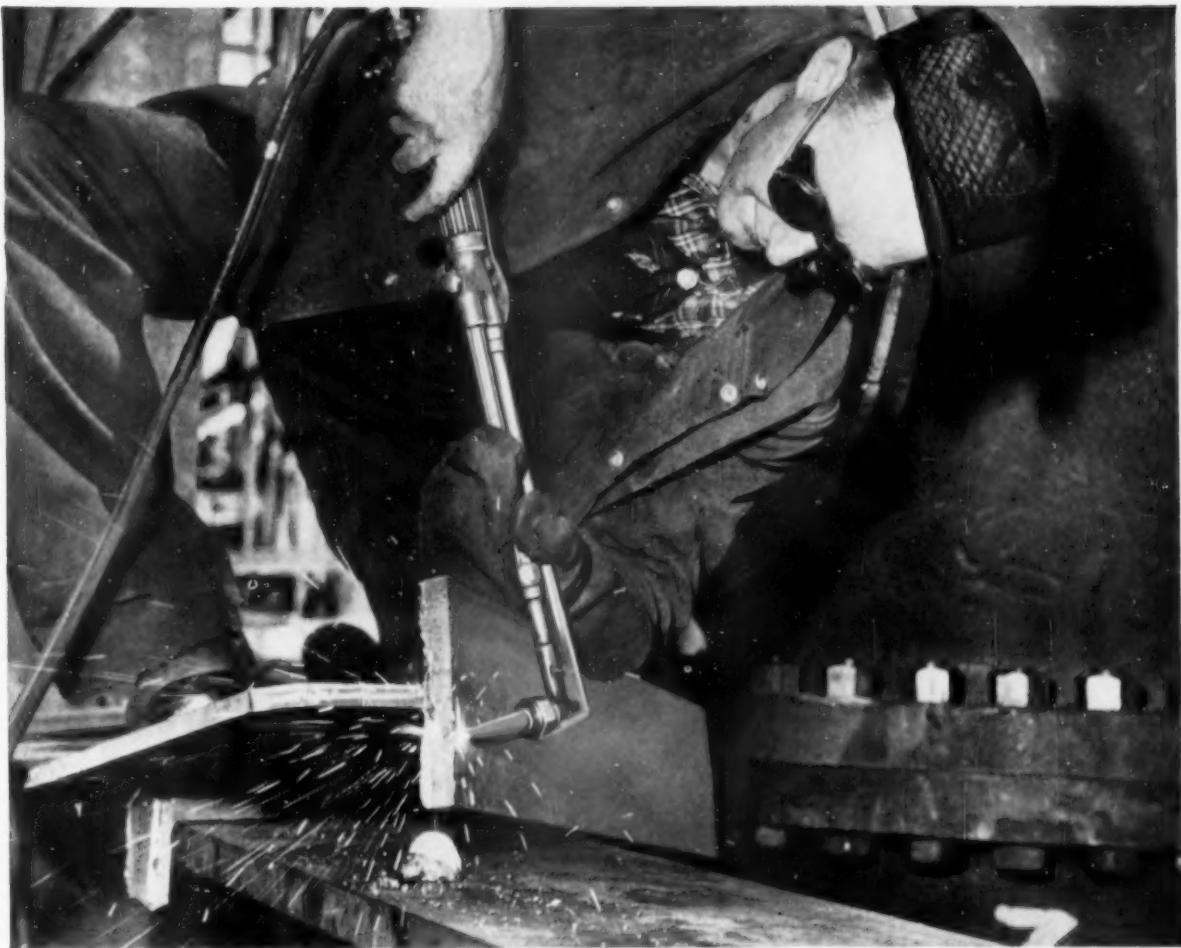
Lindberg also specializes in field installation. We call this part of our business Lindberg Industrial. Whether your requirements call for the installation of a big one like the aluminum reverberatory furnace shown below or a complete heat treating department of smaller units, Lindberg will handle the job all the way. We specialize in "turn-key" installations, covering everything from design and engineering to the finished job. This includes all the construction needed to fit the equipment into your production processes.



**LINDBERG** *heat for industry*

Lindberg Engineering Company, 2450 W. Hubbard St., Lindberg Industrial Corporation, 2321 W. Hubbard St., Chicago • Los Angeles plant, 11957 S. Regentview at Downey, California • EFCO-Lindberg, Ltd., Montreal, Canada • Lindberg Italiana, Milan, Italy • The Electric Furnace Company, Ltd., Weybridge, Surrey, England • Etablissements Jean Aubé, Paris, France • Lindberg Industrie Ofenbau, Gross Auheim, Germany • Toyo Menka, Tokyo • Lindberg Engineering Company (Australia) Pty. Ltd., Melbourne

Printed in U.S.A.



**VICTOR TORCH** with cutting tip of Anaconda Tellurium Copper, which has the resistance to heat and wear required to maintain uniform flame characteristics through a long life of service.

## Tellurium Copper makes better cutting and welding tips



Two typical Victor torch tips of Anaconda Tellurium Copper-127 shown full size.

**THE PROBLEM:** Victor Equipment Company of San Francisco first used regular leaded copper rod in making tips for its line of cutting and welding torches. In some applications, however, the leaded copper did not stand up under high heat conditions.

**THE SOLUTION:** Victor tried Anaconda Tellurium Copper-127 Rod and found the answer. The Tellurium Copper had a much higher heat resistance. This meant long, trouble-free service for its precision-made cutting and welding torches in all types of applications. At the same time, the Tellurium Copper provided uniform machinability, especially important in drilling the deep holes prior to completion by swaging on mandrels.

**FREE TECHNICAL SERVICE:** No matter what your special problem may be, The American Brass Company can very likely furnish free-cutting copper and copper-alloy rod to meet the requirements of the product or the operation.

It is the function of the Technical Department of The American Brass Company to assist metal users in the selection of Anaconda Rod. This service is at your disposal without charge or obligation. Comprehensive data on composition and machinability of standard Anaconda Rod Alloys, together with specification references, weights and dimensions, are available in Publication B-3. For this booklet—or technical assistance—write: The American Brass Company, Waterbury 20, Conn.

6768

**ANACONDA® COPPER and COPPER ALLOYS**  
**MADE BY THE AMERICAN BRASS COMPANY**

# AUTOMATION

## *for the small manufacturer ... at a small capital cost*

It's becoming more and more obvious that small and medium size plants must get into automated production if they're going to live through the price battle with larger, better equipped plants.

But too often small plant owners tend to shy away from "automation" because they believe large capital costs are involved.

Automation on a limited budget becomes practical when you think of automation not as an "automatic factory" but as a means of cutting costs on a lot of separate and often unrelated operations.

Automatic feeding of tools in such work as drilling, reaming, tapping, milling, forming, staking, etc.; automatic clamping and holding of work pieces; dial feeding of work pieces to tools; combining two or more operations on one machine with one operator instead of two; grouping and interlocking assembly operations for quicker parts handling and faster assembly—

These are practical automation steps which any manufacturer can take—with a minimum of invested capital—and a minimum of time.

### ***Bellows Pneumatic Work Units Make it Relatively Easy***

Bellows pneumatic work units (tool feeds, work feeders, work holding and clamping devices) are self-contained power units which can be quickly installed on practically any standard machine or machine tool. Air-powered, electrically actuated, and (if desirable) hydraulically controlled, they

can be synchronized with the basic machine to perform automatically a wide range of functions. As packaged power units they can be readily combined with cataloged parts (switches, mounting plates or brackets, drill heads, etc.) to form inexpensive special purpose machines.

### ***Your Bellows Field Engineer Can be of Real Help***

Some 150 Bellows Field Engineers (one or more in each major industrial area) will work with your methods

or tool engineers in adapting these low cost work units to your production line.

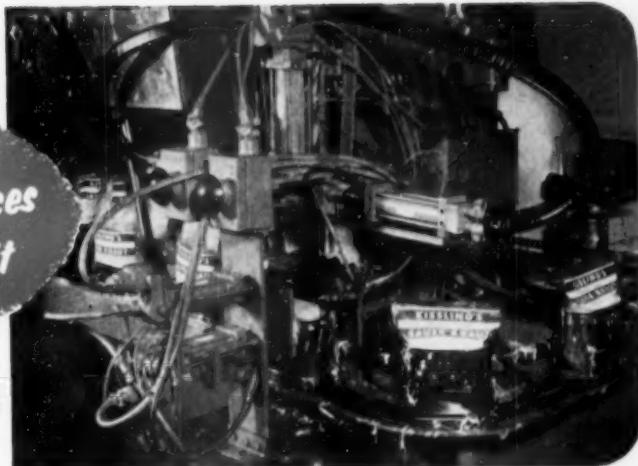
### ***Take this step-NOW!***

Let us send you, without cost or obligation, a collection of data on Automation particularly as it applies to the small or medium sized manufacturer. Included are reprints of articles in leading trade publications; typical case history stories showing how Bellows equipment is being used by manufacturers, and, of course, full information on the principal Bellows work units.

Write Dept. TE 1157, The Bellows Co., Akron 9, O. for the "AUTOMATION PORTFOLIO."

**\$5000 Shop-Made  
"Packager" Replaces  
\$20,000 Unit**

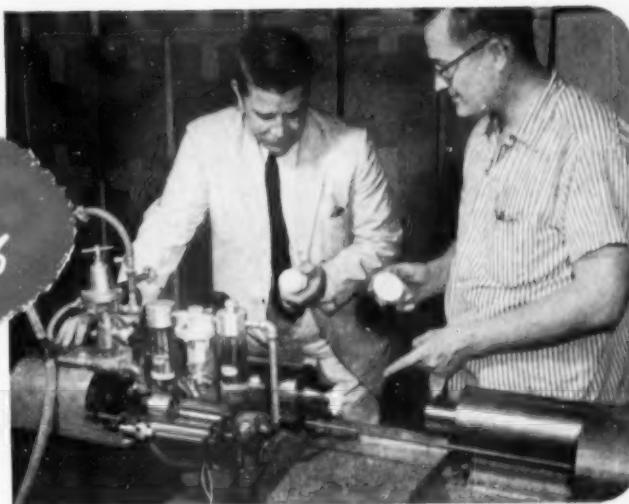
A. C. Kissling Co.  
Philadelphia



Rejects from a \$20,000 conventional machine for packaging sauerkraut were a consistent 17%. For a total cost of \$5,000, a toolroom-built machine operated by nine electrically interlocked Bellows Air Motors, packages and seals 6300 packages in 8 hours...twice the production of the replaced unit. Rejects are a maximum 2%.

**For \$187.05  
Unit Cost was  
Reduced 75%**

The Brittain  
Products Co.  
Cuyahoga Falls, O.



Spinning polyethylene shells to form a plastic ball was a hand-controlled operation producing 5 balls per minute...rejects were high, the operation was tiring. A Bellows Air Motor with hydraulic control, limit switches and an air filter...costing \$187.05...replaced the hand operated lever. Production is now 20 balls per minute. Same quantity of production is obtained in two hours as formerly obtained in eight hours, quality is uniform with very few spoiled parts.

**Five Times  
Production...  
Half the Labor Cost**

The Hedman Co.  
Chicago



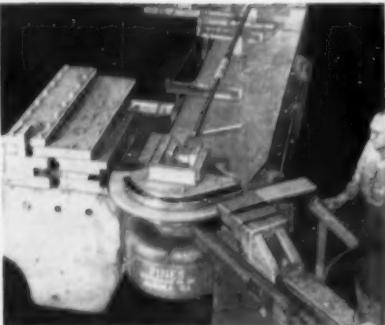
Hand drilling and tapping check protector parts required two skilled operators to produce 125 parts per hour...not enough to meet requirements. The two drill presses were then equipped with electrically controlled Bellows Drill Press Feeds, synchronized with a Rotary Feed Table to feed the parts to the spindles. The Bellows equipment cost \$1,300. One operator now handles both the drilling and tapping operations. Production is 650 parts per hour.

→ **The Bellows Co.**  
AKRON 9, OHIO

932-B



**HEAVY RECTANGULAR TUBES** accurately formed on Pines Model 4 on a 24" inside radius for air cushion assembly on heavy duty truck chassis. Material is 4" x 5½" x .200" wall.



**SOLID STEEL BEAMS** cold edge bending of 5½" x 1½" steel bars on Pines Model 4 replaces hot bending on dozer, produces more accurate parts at lower cost for road machinery manufacturers.

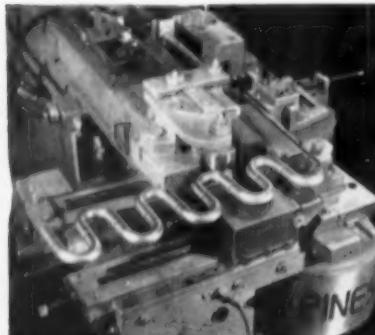
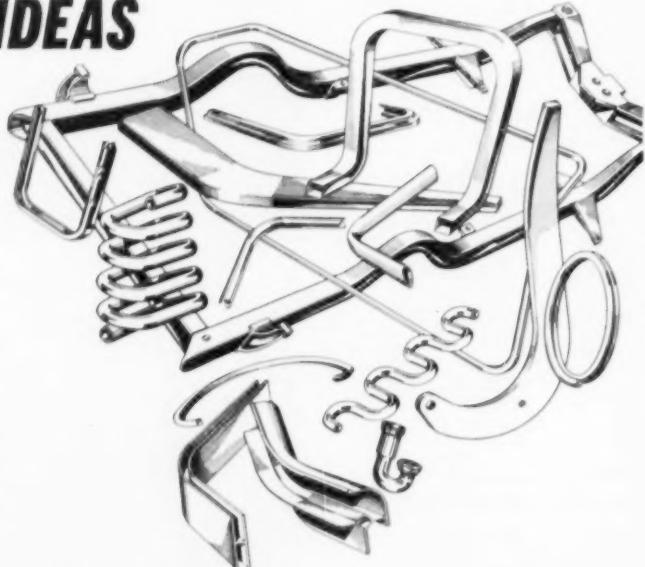


**ALUMINUM CHANNELS** rugged machine construction and tooling on Pines Model 3 Machine cold forms 4" x 1½" x .350" aluminum channel without wrinkling or distorting. Spring-back is controlled by simple machine settings.

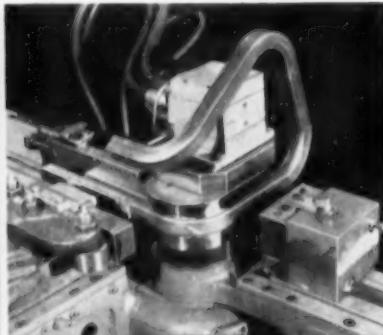
## FOR COST CUTTING IDEAS

### INVESTIGATE PRODUCTION BENDING THE "PINES-WAY"

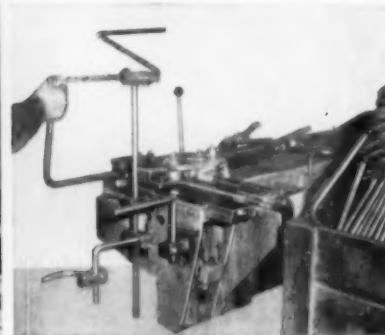
When you have a production job requiring the cold forming of parts from round, square, rectangular, extruded, or hollow stock to an even radius, or to different angles, we suggest you investigate the cost cutting advantages of production bending the Pines-way. The examples shown here illustrate a few of the many different and varied applications which are today profitably produced on Pines machines. Cold bending is a fast, accurate, easy to control metal forming process that is today more profitably applied in the production of an ever increasing variety of products. Call on Pines engineers for assistance without obligation on any specific job.



**COPPER SERPENTINE BENDS** ¾" O.D. x .035" copper tubing is rapidly formed on this Model ½ into serpentine coils on a 1" cir. A simple gang-slitting operation produces 180° return bends.



**WRINKLE-FREE SQUARE TUBE BENDING** Model 1 Machine, equipped with flexible mandrel and self-opening bending form, produces top quality office and hospital equipment at speeds of 250 bends per hour.



**FAST ROUND-TUBE BENDING** Pines Model ¾ Machines speed production of tubular dinette and lawn furniture. Fast, automatic cycling and accurate progressive bending produce 600 to 900 bends per hour.

**PINES** ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

693 WALNUT • AURORA, ILLINOIS

PRODUCTION BENDING • DEBURRING • CHAMFERING MACHINERY

#### WRITE FOR FREE DATA SHEETS

To keep abreast with bending, write for free copies of "Pines News" — gives complete data on new production applications.



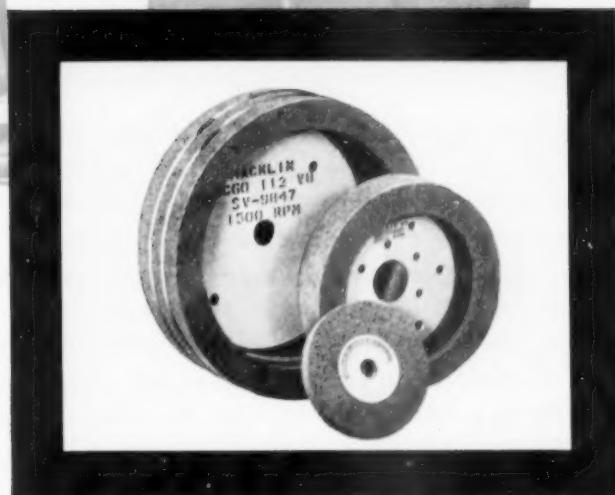


what MACKLIN  
V-8 wheels  
have saved  
for others is not  
near so important  
as what they will  
save you

IF YOU GRIND CARBIDE, you ought to try Macklin's newest "Wheel of Profit" on your job to get the FEEL of it. V-8 is easy on tools, easy on the operator's wrist. It cuts fast and cool without operator fatigue. Production goes up!

#### Here's proof . . .

V-8 non-slotted wheel saved 10% on purchase price over slotted wheel previously used...and customer reports "Though the V-8 wheel lasted only a couple of hours longer, it produced almost twice as many tools as the competing wheel."



#### Write today for V-8 literature and wheel recommendations.

While you're at it, arrange for a trial demonstration. Just call your nearest Macklin distributor, or if you prefer, write direct.



**MACKLIN company** Dept. 32 Jackson, Mich.

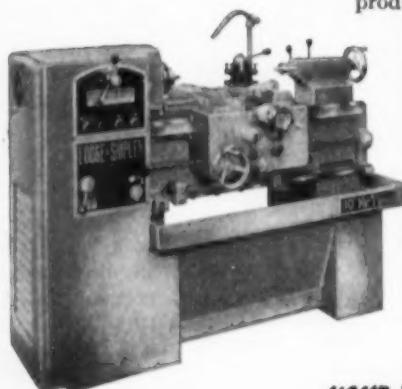
MACKLIN OF CANADA, LTD., Harrow, Ont., Canada

Quick  
as a...

on a lathe  
specifically designed  
for production  
with accuracy and economy



High speed turning, boring and facing are child's play . . . with the Lodge & Shipley HI-TURN Lathe. Whether on single or multiple-piece work, this 10" Production Lathe provides productive capacity at a price substantially below conventional lathes.



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The 10" HI-TURN gives you horsepower, rigidity and production you would normally expect to find in lathes costing twice as much. We can prove more production per lathe dollar . . . more production per operator hour!

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**Lodge & Shipley**

Now, all former hot rolled  
Crucible REX high speed rounds  
supplied with a new thrift finish



Here's a revolutionary, new Crucible policy designed to provide an improved product—save time and processing costs. Now, Crucible furnishes all REX® high speed rounds from  $\frac{5}{8}$ " up with a machined surface, close to size and free from decarburization. All bars from  $\frac{1}{4}$ " to  $\frac{5}{8}$ " round are supplied cold finished.

This new *thrift* finish means important savings to you — whether you've been paying extra for decarburization and stock removal, or grinding or rough turning rounds in your own shop. Of course, where extremely close tolerances are demanded, precise centerless grinding is still available at a small extra.

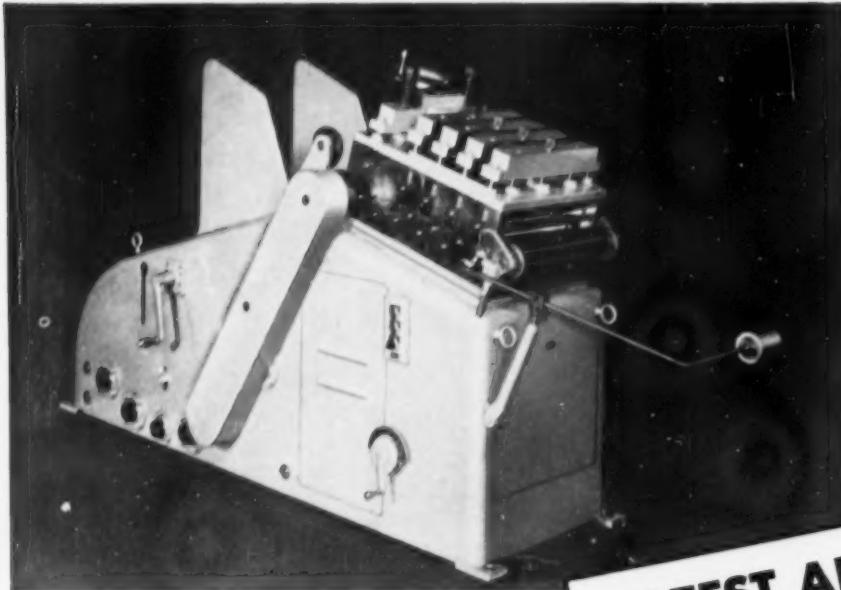
It's another Crucible "first" that offers you substantially more for your high speed steel dollar. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

**CRUCIBLE**

first name in special purpose steels

**Crucible Steel Company of America**

Canadian Distributor — Railway & Power Engineering Corp., Ltd.



LATEST ADDITION  
TO THE LINE OF



## FOR EFFICIENT COIL HANDLING

Units in the line of U. S. Automatic Press Room Equipment are designed to help you reduce stamping costs through the efficient use of stock in coils. The Model PDSC-1648 Combination Coil Cradle—Power-Driven Straightener illustrated above, has a capacity for material up to 16 inches in width,  $\frac{1}{8}$ -inch in thickness, in coils up to 48" O.D. It is the latest addition to the U. S. line designed to help you gain all the cost-cutting potential inherent in the use of coil stock. Where floor space is a factor, a Combination Unit like this can often be used in an area too small to accommodate a separate Straightener and Cradle.

Satisfactory feeding into the press is often dependent upon: (1) the straightness of the stock and (2) the manner in which the coil is supported and unwound. U. S. Stock Straighteners, Stock Reels, Coil Cradles and Combination Units are built in a range of sizes and types to suit your particular requirements.

Ask for Bulletins 80-T and 95-T for detailed information on units in the line of U. S. Automatic Press Room Equipment.

### U. S. PRODUCTS

- Slide Feeds
- Roll Feeds
- Stock Straighteners
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- Stock Oilers
- Coil Cradles
- Wire Straighteners
- Die Sets
- Multi-Slides®
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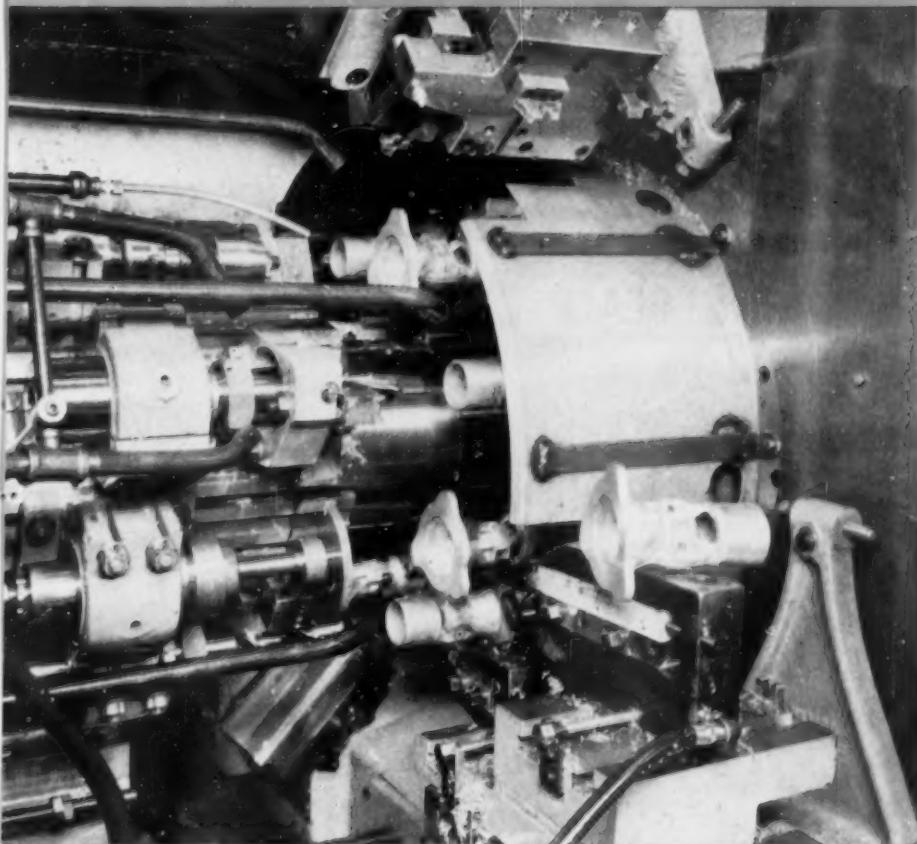
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AMPERE (East Orange)

NEW JERSEY

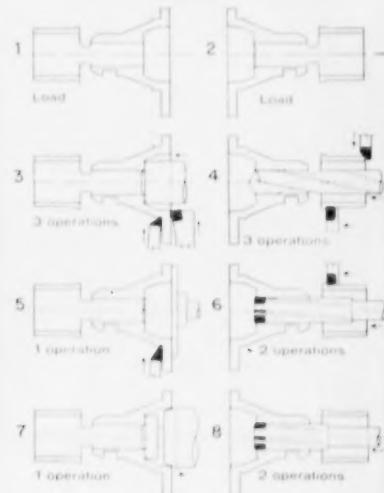
# Acme-Gridley

## RPA-8 SPINDLE CHUCKER



BASKET HUB  
ALUMINUM DIE CASTING

Double indexing—both ends completed at one setup on 6" RPA-8 Acme-Gridley Chucking Automatic.



12 operations in 13 seconds



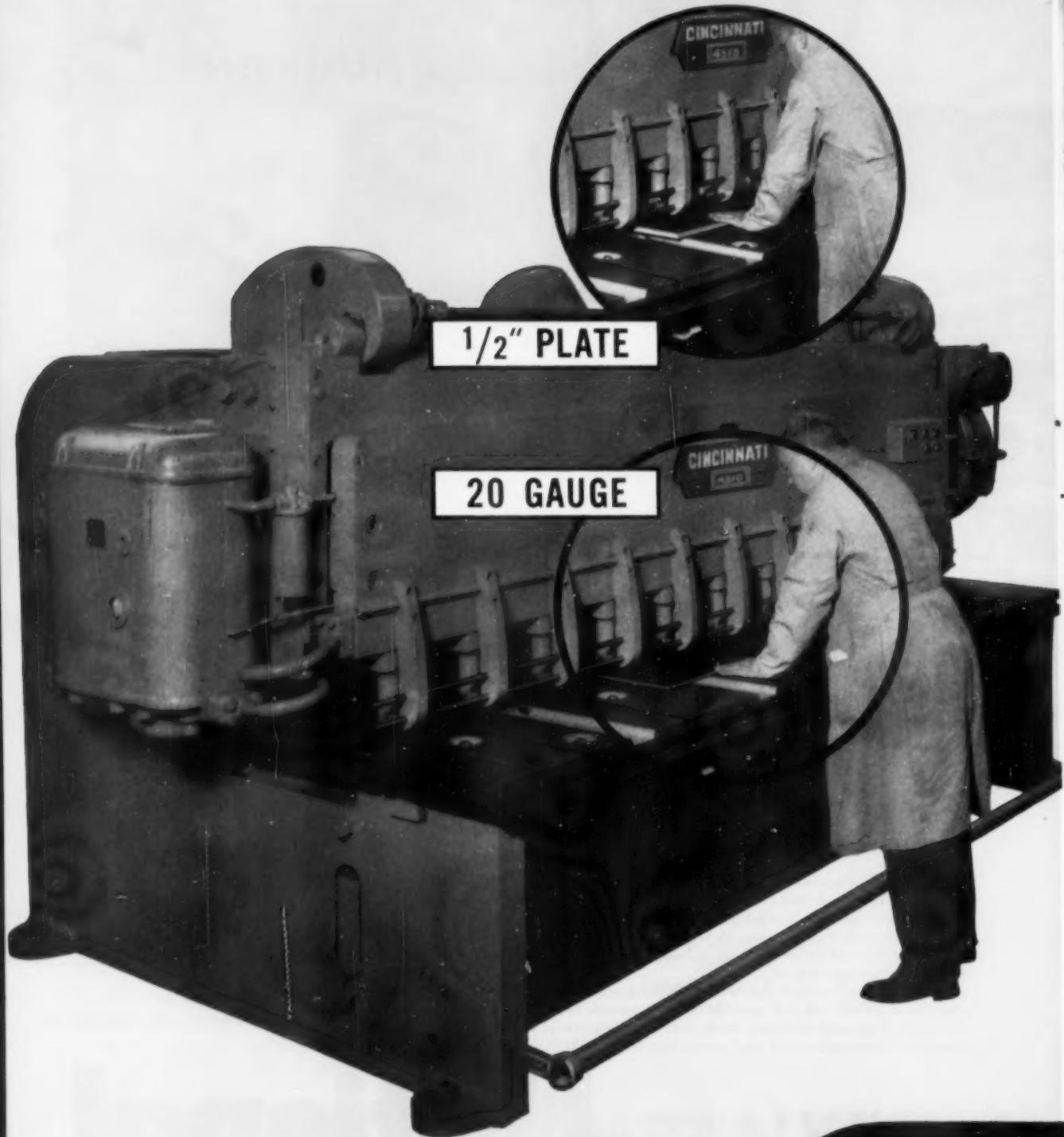
Write today for  
Bulletin Nos. CM-44 and CM-51A

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# CINCINNATI



This machine is a good example. It's a 4310 Series Cincinnati, with a capacity of  $\frac{1}{2}$ " by 10' mild steel. The photos show it accurately shearing  $\frac{1}{2}$ " plate and 20 gauge sheets . . . with the same knife clearance.

# accurately shears thin sheet and heavy plate...

## **without changing knife clearance!**

You don't have to change knife clearance each time you cut a different thickness on a Cincinnati Shear. With the knife clearance set for thin material, Cincinnati Shears will accurately cut all thicknesses up to capacity.

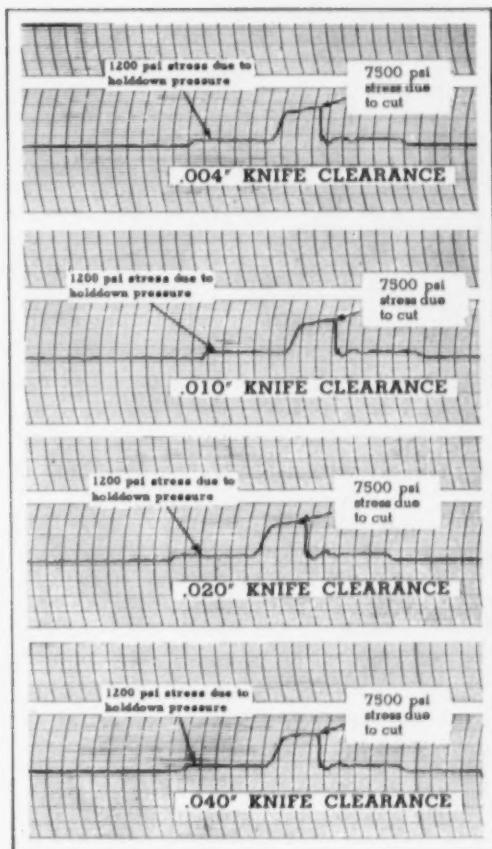
This statement is being demonstrated daily, by the thousands of Cincinnati Shears in operation. Carefully conducted engineering tests have proven the following facts:

Knives last just as long when cutting different thicknesses with one knife clearance, as when clearance is changed for each thickness.

- A Cincinnati Shear works no harder when cutting with a close clearance than it does with a large clearance.

Shearing with one knife clearance is safe, since thin sheets cannot become accidentally wedged between the knives. Cincinnati Shears with single knife clearance are time-savers, since the unnecessary clearance-changing operation is eliminated.

The results of two of these tests are shown at the right. For complete information on Cincinnati All-Steel Shears, write Department E for Catalog S-7R.



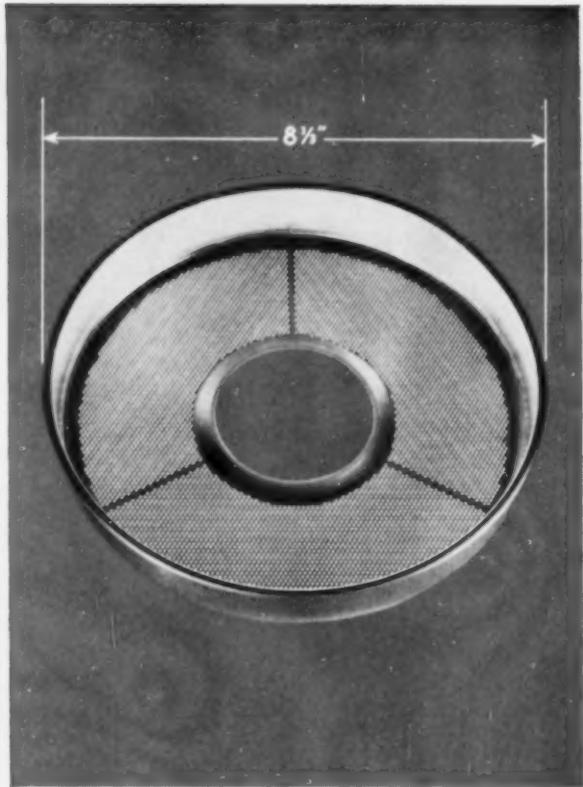
These tests show stress in a Shear frame when cutting heavy material, using different knife clearances. They prove that cutting pressure is not affected by knife clearance.

## THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • PRESS BRAKES



## FIELD REPORT: NO. 2028



## WHICH DIE STEEL WOULD YOU USE to be sure of getting 6,066 perfect holes in this die?

These tools are used in a 60-ton press to pierce 6,066 holes of .036" dia. in aluminum filter pans for a popular home appliance. The job demands "almost everything" from the die steel . . . good machinability and uniformity, minimum size change, extra safety in hardening and toughness to withstand heavy press loads.

The filter pans are 8 1/8" in dia., and .025" thick. The 6,066 holes are perforated in three blows, as the die moves through three 120 degree indexing stations. Hundreds of machine hours are involved in drilling and taper reaming the tiny holes.

If the decision were up to you . . . on which die steel would you be willing to stake your reputation in view of this tough set of requirements?

In this Field Report from customer files, here are the amazing results: Working with Carpenter VEGA (Air-Tough) Die Steel, the company reports that not a single "hard spot" was encountered . . . all 6,066 holes are in the die as planned. The machining of VEGA was "considerably easier" than the machinery steel used for the stripper plate. What's more, there was no discernible change in size or shape after heat treatment . . . the die held perfectly!

You can count on good results from any Carpenter Matched Tool and Die Steel. Take the risk out of your tough tooling jobs. Call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now for immediate delivery.



# Carpenter STEEL

**C** Matched Tool and Die Steels

The Carpenter Steel Company, 154 W. Bern St., Reading, Pa.

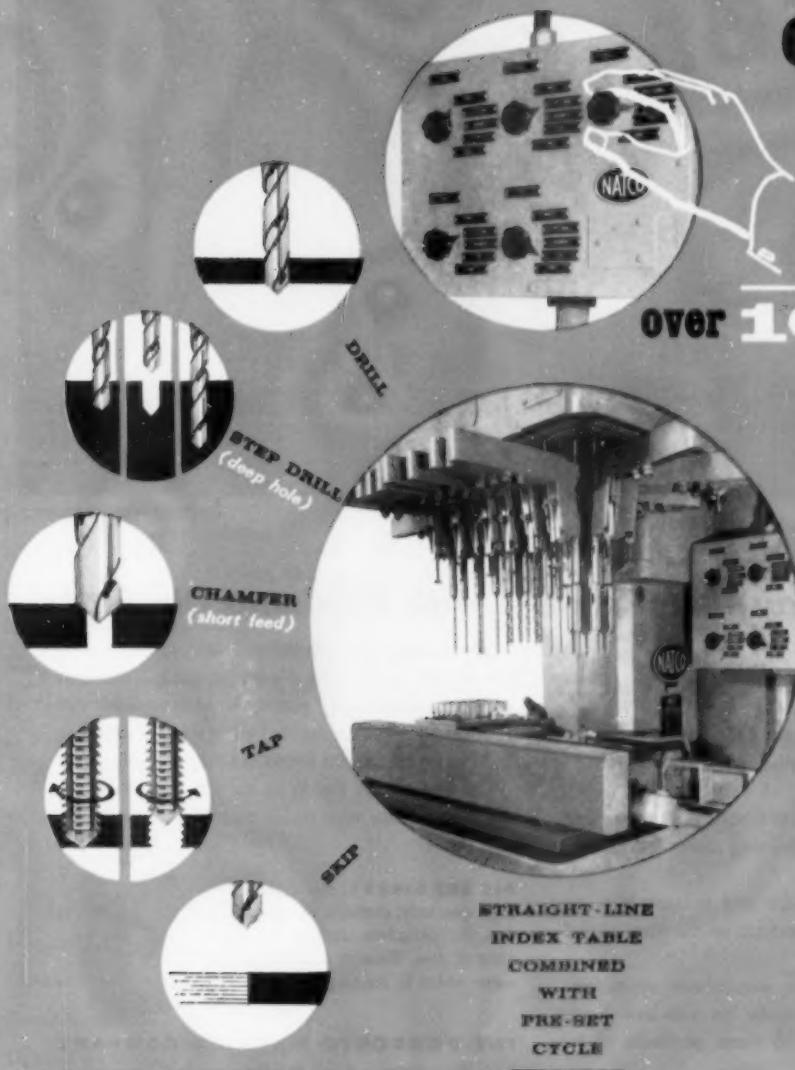
Export Dept.: The Carpenter Steel Co., Port Washington, N. Y.—"CARSTEELCO"

# Natco Naturals

**Cost-Cutting Ways  
You Can Use  
Standard Multi-Spindle Natcos**

Any time your parts require machining *more than one hole*—drill, bore, face or tap—it may well be a "Natco Natural." Your standard Natco will produce substantial savings in a surprising number of situations, *even in small job-shop lots!* Call in your nearby Natco field engineer; he'll tell you in short order whether you've got a "Natco Natural" there.

## NOW... Set up quickly with a twist of the wrist



**5 cycles  
5 positions  
over 100 combinations**

*The five-position table mounted on a Natco H-6 adjustable spindle machine equipped with selector control panel makes it possible for the operator to pre-set over 100 machining combinations. Thus the capacity of the machine is greatly increased in number of holes, in complexity of hole patterns, and in variety of machining operations. Machine investment is kept at a minimum for the volume of work produced.*

### Select either of

- 2 DEPTHS OF FEED**  
*automatically*
- 2 FEED RATES**  
*automatically*
- 2 MOTOR SPEEDS**  
*automatically*
- 2 INDIVIDUAL SPINDLE SPEEDS PLUS NEUTRAL**



*Standard multi-spindle Natcos range from 1 hp, 10-spindle machines to 50 hp machines with up to 72 spindles. Spindles in standard Natcos are driven through universal joints and located by either adjustable arms or bored slip plates.*



## National Automatic Tool Company, Inc.

*Richmond, Indiana*

*Multi-spindle drilling, boring, facing & tapping machines. Special machines for automatic production.*

*Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.*

# Why the Die Maker Prefers **PRODUCTO** Die Sets



Volkert Stampings, Inc.

## ***The die maker likes to work with Producto Die Sets***

He knows Producto die sets are easy to assemble—especially those equipped with the unique new Qwik-Fit Guide Pins\*.

He has confidence in the consistent accuracy of Producto sets. He has found that they always align his dies correctly.

He knows he can choose from a variety of thicknesses the Producto die set that meets the strength requirements of his die.

He favors Producto die sets because they are dependable. They will perform on the press as well as they did in tryout.

He likes the attractive, streamlined appearance of Producto sets. They make his dies look better and increase his pride in these products of his craftsmanship.

\*Patent Pending

He knows that a nearby Producto warehouse can supply any catalog die set he needs...and that orders for specials are promptly processed. He can count on having the die set by the time he needs it.

The die maker has found that all of his requirements are met by Producto die sets. You will, too, when you place your order with Producto.

**DIE SET DIGEST**, our eight-page quarterly, contains valuable data for designers, makers and users of dies. Write to have your name added to mailing list.



**THE PRODUCTO MACHINE COMPANY**  
930 Housatonic Ave., Bridgeport 1, Connecticut



Wherever die sets are used

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PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

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## 5. Europäische Werkzeugmaschinen Ausstellung.

Those of us who had the privilege of visiting the spectacular exhibition of modern machines, tools and gages at Hannover were well rewarded. The surroundings of the magnificent buildings for displaying machine tools will be long remembered. It is hard to realize the quick recovery made by European nations and Great Britain since the recent war. To manufacture the machines exhibited at this fair is indeed a marvel. They have all the engineering features that are recognized as necessary the world over for manufacturing at a cost that makes our present high standard of living possible.

It is impossible to describe in this brief space all the outstanding machines, tools and gages or to discuss the organization of every detail of this outstanding show. Every facility possible was made available to make it a pleasure and to encourage the vistor to spend every minute inspecting cost-saving equipment.

One exhibition hall displayed cutters, drills, taps and gages. This display—together with ten other large exhibition halls filled with transfer, fully automatic and standard machine tools in operation—was an inspiring sight.

As a sidelight on the show, it is interesting to note that some of the companies exhibiting at this year's fair come from countries that just a few years ago were not considered in the machine-tool field. Machines exhibited by these companies are among the finest in the world today.

As one American expressed it, "These fellows will tackle anything and they are doing a darned good job."

*HC Collins*  
PRESIDENT

American Society of Tool Engineers



# 2351

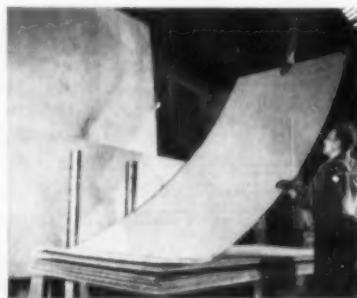
## types, shapes, sizes and finishes of Allegheny stainless in stock at Ryerson

When you want stainless fast . . . anything from one to 2351 types, shapes, sizes and finishes . . . telephone Ryerson. You can

depend on accurate processing and quick shipment from Ryerson . . . the nation's oldest supplier of stainless from stock.



**STAINLESS SHEETS** — Eleven analyses of Allegheny stainless sheets, including nickel and straight chrome types. Extra wide sizes, also, to reduce welding costs. Expanded and perforated sheets.



**STAINLESS PLATES** — Nine analyses, including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.



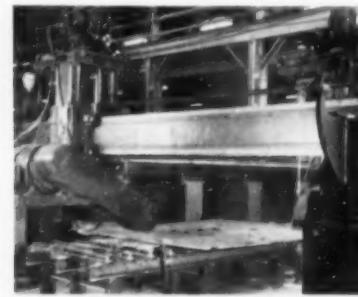
**STAINLESS BARS AND ANGLES** — Eight types, including rounds, squares, flats, hexagons and angles. Free-machining bars with both analysis and mechanical properties controlled for best performance.



**STAINLESS PIPE AND TUBING** — Light wall, standard and extra heavy pipe, ornamental and regular stainless tubing. Also screwed and welding fittings and Cooper stainless valves.



**STAINLESS CIRCLES, RINGS, SPECIAL SHAPES** — No matter how intricate, we can flame-cut practically any shape from stainless steel plate. One piece or a thousand.



**TRUE-SQUARE ABRASIVE CUTTING** — Stainless plates up to 12' x 25' cut absolutely square on abrasive disc machine. Length and width tolerance plus or minus 1/32".

*Principal products: Carbon, alloy and stainless steel — bars, structurals, plates, sheets, tubing, industrial plastics, machinery and tools, etc.*



## RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK • BOSTON • WALLINGFORD, CONN. • PHILADELPHIA • CHARLOTTE • CINCINNATI • CLEVELAND  
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# MANUFACTURING RESEARCH

## a plan for the future

By **Adolph Vleek, Jr.**  
Director, Manufacturing Engineering and Research

and

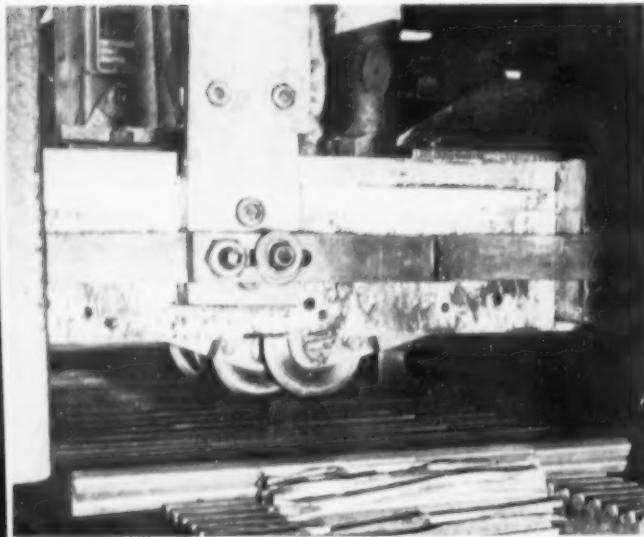
**L. E. Laux**  
Chief, Manufacturing Research and Development  
The Martin Co.  
Baltimore, Md.

The Martin Company's unique approach to research in the manufacturing area has attracted wide attention in industry. Because of the vital significance of this subject now and for the future, the editors believe both executives and engineers will be keenly interested in this interpretation of manufacturing research.

**T**HERE ARE PROBABLY AS MANY definitions of research as there are companies, and no doubt they are all valid as they apply to individual situations. At Martin, manufacturing research effort is divided into three phases: (1) the constant improvement of existent manufacturing processes; (2) the development of processes to meet new engineering designs; and (3) the development of processes for new materials to be used in future products. These three facets of research and development are indispensable in a competitive system. The first provides increased efficiency and productivity; the second enables the company to produce new and improved products; and the third makes it possible to determine what materials and methods will be used in future production.

A frequent question is: "What is the difference between research and development?" There is much

conjecture as to where research stops and development starts. Some believe the two are inseparable; others believe there is no difference. The only conclusion that it has been possible to reach is that research is the scrap thrown away and development is the end product that is kept. Actually, research is the method of arriving at the development.



## Research Organization

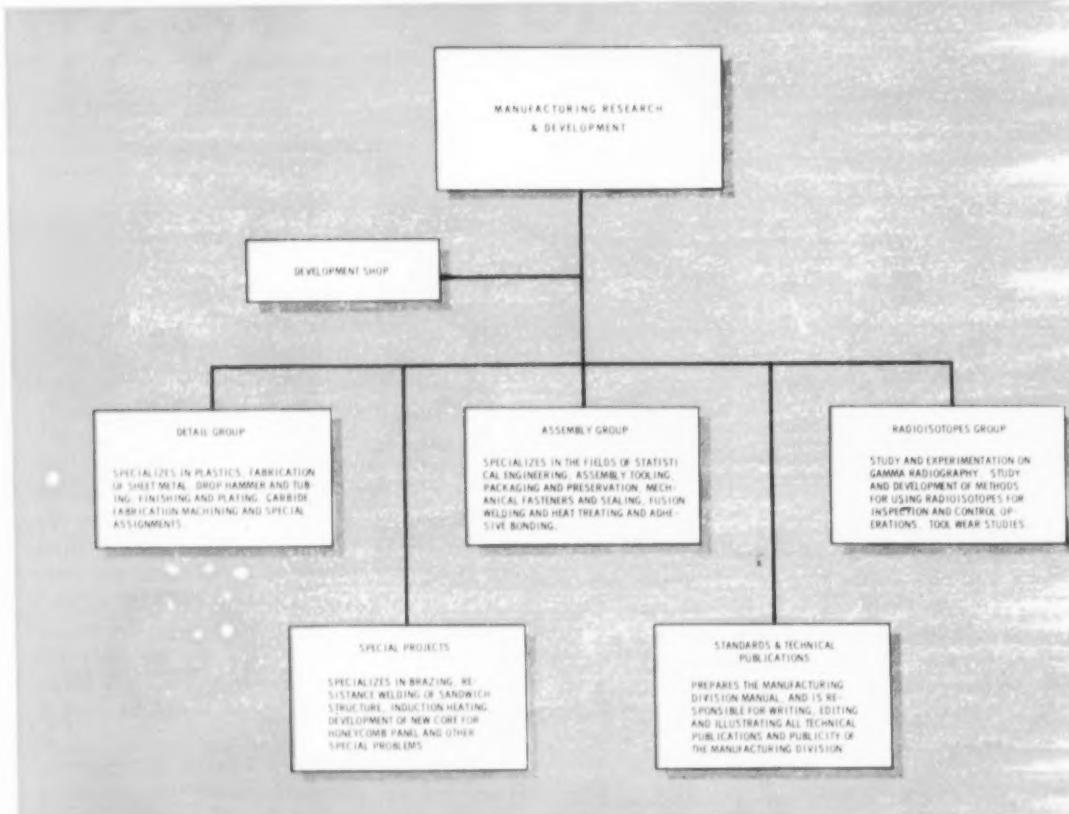
Martin separates research for design engineering from manufacturing research. Engineering research solves problems attendant on the development of new products, while manufacturing research solves problems of the economic and efficient production of these products. This discussion is, of course, concerned with the latter.

To perform its activities, the manufacturing research department is divided into five groups. Each of these groups is divided into teams of specialists working in their respective fields. Each team is directed by a senior research engineer with specialized research engineers and analysts covering the many facets.

As an indispensable adjunct, there is the development laboratory where all the experiments are conducted and the processes developed and proved. This laboratory is furnished with all the necessary machinery and equipment for the development of

(left) New materials, new processes and new tools developed in manufacturing research are exemplified in this seam-welding setup. Six wheels synchronously produce a section of stainless honeycomb.

(below) Chart of organization of manufacturing research and development showing areas of responsibility of specialized groups.



processes, machinery and equipment. The breakdown of group responsibilities is as follows:

**Detail Process Development Group:** This group performs research in sheet metal forming, machining, machine theory and development, automated equipment, finishing and plating, and develops the use of plastics in tooling and products. Also, the specifications for all machinery and equipment are determined in this group.

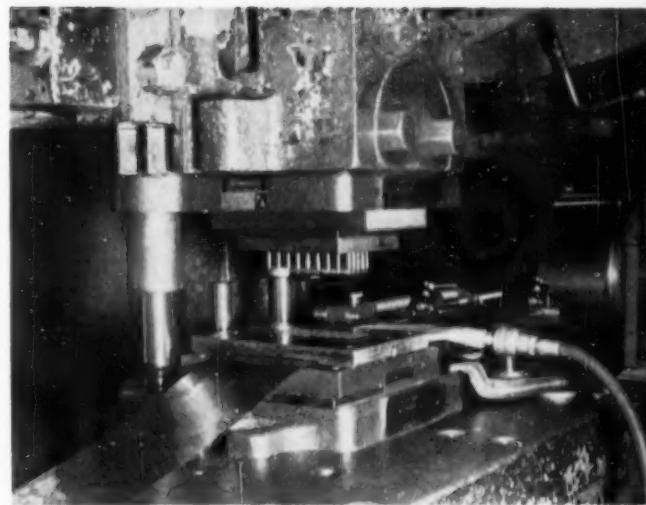
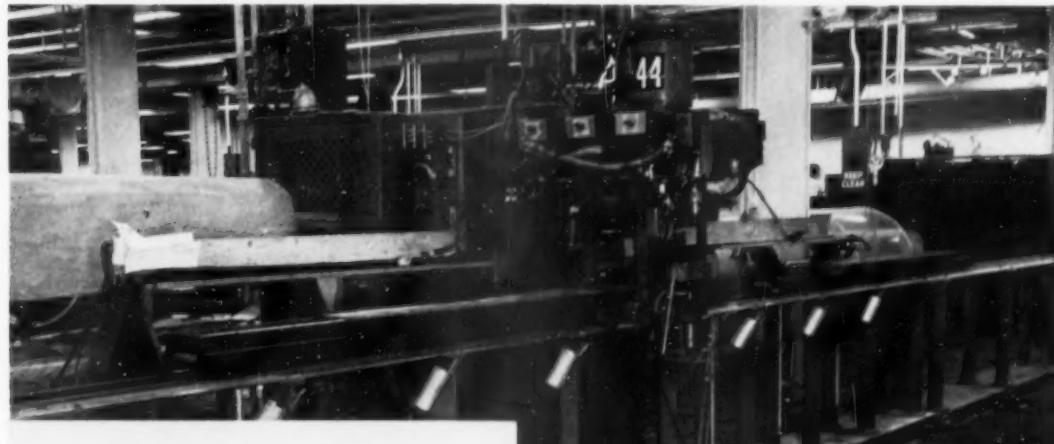
**Assembly Process Development Group:** Research in the fields of fusion welding, heat treatment, adhesive bonding, brazing, manual and automatic mechanical fasteners, resistance welding and the certification of all machines are carried out in this group.

**Special Projects Group:** Any unusual problems demanding immediate attention, which develop in any of the above fields, are handled by this group.

**Radioisotopes Group:** The development of methods for using radioactive sources for inspection and control, such as radiography, tracers and tool wear studies, is carried out by this group. It is also concerned with developing new uses for radioisotopes, an endeavor which will cut costs and improve process control.

**Standards and Technical Publications Group:** The standards group prepares, publishes and distributes information describing the standard manufacturing processes, specifications and operating instructions for tools and equipment. This information serves as a guide for process planners, tool designers, toolmakers, engineers and manufacturing personnel. It is also a valuable reference for

**Semiautomatic setup developed for seam welding honeycomb core. Special resistance welding machine can handle ten-foot cores in carriages which ride on a 40-foot bed.**



Processes, tools and equipment are devised for each experimental operation, as in this setup for piercing stainless foil. The piercing of the stock permits escape of volatile gas produced when skins are bonded to the core.

quality control and industrial engineering departments.

The technical publications group writes and illustrates all technical and research reports. In essence, the publications group endeavors to translate the ideas and activities of manufacturing research and development into words and pictures to provide information to both engineering and manufacturing of manufacturing capabilities and limitations.

#### What Are Research Problems?

Defining what is and what is not a research problem can be difficult. At Martin, it is believed that any material processing problem that impairs the company's ability to do the job or reduces efficiency or productivity is a problem to be solved by manufacturing research and development. To explain,

take an example of a recent problem that confronted manufacturing research and development.

A new product was being planned. While it was still in the proposal stage, design engineers determined that stainless steel would be the material best suited to meet certain stringent design specifications of an advanced nature. Since the manufacturing division had only limited experience in fabricating stainless steel, a program was initiated to develop the required processes. This study provided the design engineers with a guide to manufacturing abilities and limitations. Each senior manufacturing research engineer set up tests to be conducted in his specialized field, and the results of this research determined the design criteria.

During this research, new processes, new materials and new tools were developed to facilitate the fabrication of stainless steel. A case in point was the manufacture of a stainless steel honeycomb sandwich structure, of a type it was impossible to secure elsewhere. In the mid-forties, Martin had developed aluminum honeycomb sandwich structure,

but nobody had ever tried using stainless steel. New processes were developed for heat treating, piercing, corrugating and joining the core. Resistance welded core was finally accepted as best. The sandwich structures were fabricated by adhesive bonding, since there was no other completely reliable method. But, due to the design specifications of temperature and stress, it was necessary to develop a new, high-temperature adhesive. While bonding technicians were working out their problems, however, brazing specialists were working on the development of a process for brazing the sandwich structure. The first assemblies were bonded with the new, high temperature adhesive, but ultimately the brazing technique was perfected. This is what is meant in reference to present and future research. Methods at hand are used with modifications to fit new jobs, but at the same time the organization is continuously researching for new and better ways of doing the job.

Another demand on manufacturing research and development comes from design engineers. At Martin the manufacturing planning engineers work directly with engineering design in the initial stages of the design of a new product. In this way the manufacturing planners are able to advise the design engineers of the most efficient and productive design. There are times when the design engineer must

(left) Processing finished honeycomb also involves new techniques. A Quackenbush router adaptation was devised to attain desired cutter speed in milling the billet to desired thickness.

(below) Typifying successful development projects is the Marforming process. It deep draws parts so that they are wrinkle free. By using a rubber blanket in a steel draw punch, tooling is simplified, with no need for matched dies.



depart from established procedures to design a superior product even though manufacturing has no fabricating technique. When this occurs, the planning engineer takes the design to the research engineers, who develop suitable production processes.

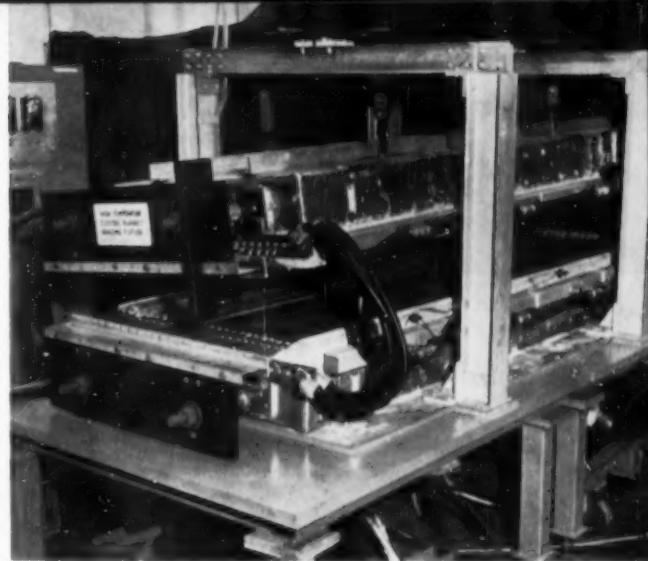
This system, of course, also works in reverse. For instance, development of the Marform deep-drawing process by manufacturing research and development gave design engineers a new flexibility for design of parts that had previously been formed by more costly and limited methods. Today, taking advantage of these techniques, engineers can design better components, which could never have been fabricated economically by the old methods.

### Research a Necessity

There was a time, not so many years ago, when research and development were considered luxuries that few companies could afford. But today research is no longer a luxury—it is a basic necessity in any industry. The nuclear age is making ever-increasing demands for new materials and for drastic new methods of fabrication. No longer can a designer talk of going from one strength to a higher strength, in the same basic material.

Design materials in use today were the tool materials used to fabricate yesterday's products. Also, with radical new power plants that give tremendous flight speeds, measured in Mach numbers, come demands for new designs to better utilize the speed that is available. Engineers are mindful of this need and are able to provide the designs. Ability to pro-

vide materials to stand the stress and heat, and to fabricate such designs is beyond present manufacturing capabilities, however. Whereas manufacturing methods in the past have kept pace with design, now design, particularly in military fields of missiles, electronics and nucleonics, has achieved a sudden break-through in knowledge that threatens to obsolete present materials and has outstripped manufacturing technology. Only through research and development will these materials and capabilities ever be made available.



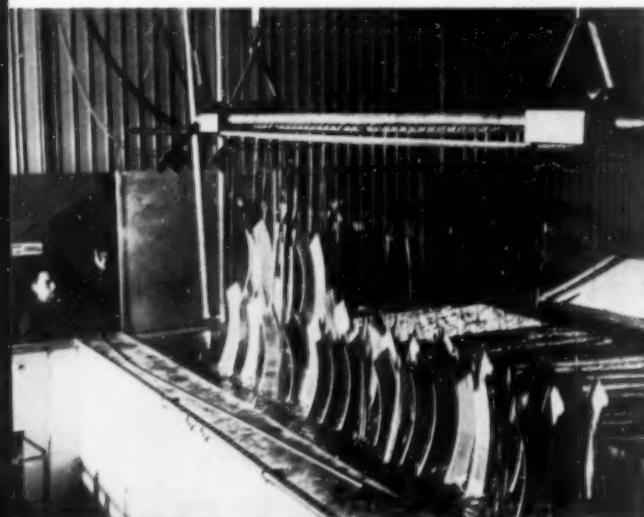
Clamshell type bonding tool is an ingenious new development for electric blanket bonding components of an assembly. By cutting across conventional lines, such imaginative tool engineering frees product designers from limitations of standard assembly-line tools and fixtures.

vide materials to stand the stress and heat, and to fabricate such designs is beyond present manufacturing capabilities, however. Whereas manufacturing methods in the past have kept pace with design, now design, particularly in military fields of missiles, electronics and nucleonics, has achieved a sudden break-through in knowledge that threatens to obsolete present materials and has outstripped manufacturing technology. Only through research and development will these materials and capabilities ever be made available.

### Future Goals

Since the atom has been split, man has made an almost incredible advance in knowledge of his environment. In reality, however, these are only the first steps of an infant. The coming of atomic power merely further boosts demands for stronger materials and better manufacturing methods. The urgency of the need for these developments constantly reminds the research engineer that his approach must ever be more fertile and imaginative. He must constantly be reaching into the future for the manufacturing technique of today.

At Martin the feeling is that this is only the beginning. There is a growing conviction that someday, through the tireless efforts of research engineers, it will be possible to control the atom to the point where atomically pure materials can be produced without the destructive hammering, cutting and pressing processes that are used today. Then, and only then, will it be possible to fully exploit the talent and imagination of design engineers. Never was it more true that today's research is tomorrow's progress.



## Adjustable Grooving Tool

Designed to utilize replaceable carbide tool bits, the grooving tool illustrated can be used with turret or single-post toolholders to cut two parallel grooves simultaneously. The distance between the two tool bits is adjustable, making the tool adaptable for a number of different jobs requiring machining of two parallel grooves.

Major components of the tool are a shank and an adjustable holder. One tool bit is held directly in the shank in a fixed position and the other is held in the adjustable holder. The holder is fastened to the shank with a socket-head cap screw and nut. This screw passes through a slotted hole in the body of the shank.

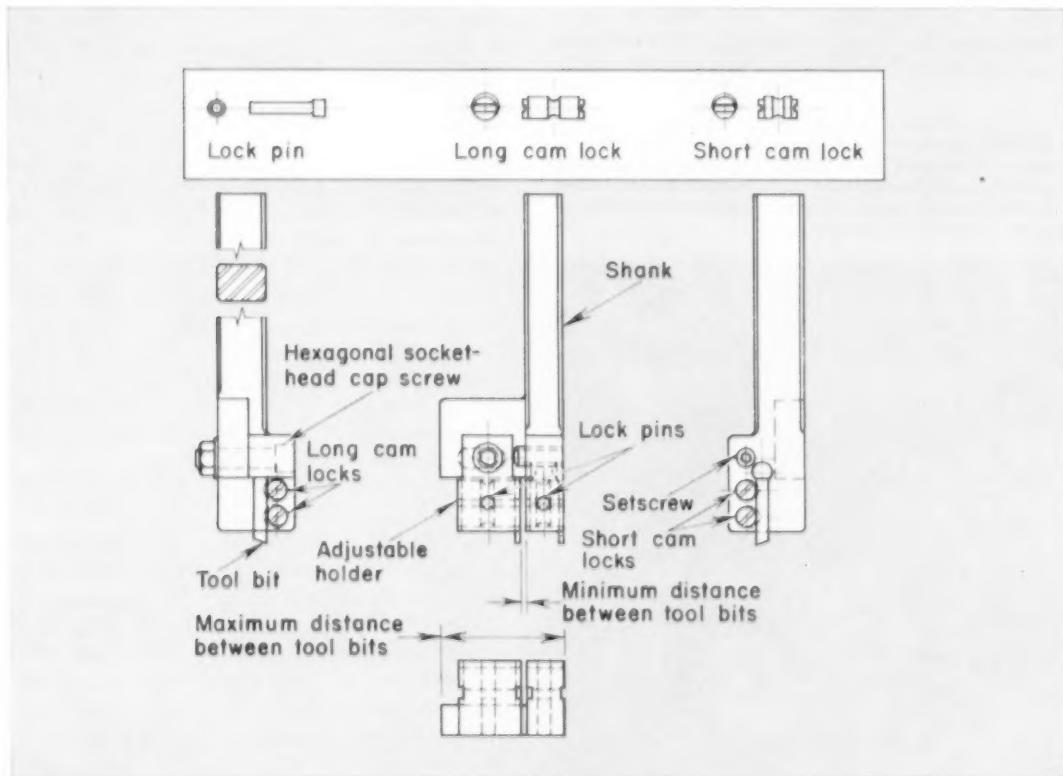
To adjust the distance between the tool bits, the nut is loosened, permitting the holder to be moved either toward or away from the fixed tool bit in the shank. A setscrew in the side of the shank permits fine adjustment. The distance between the

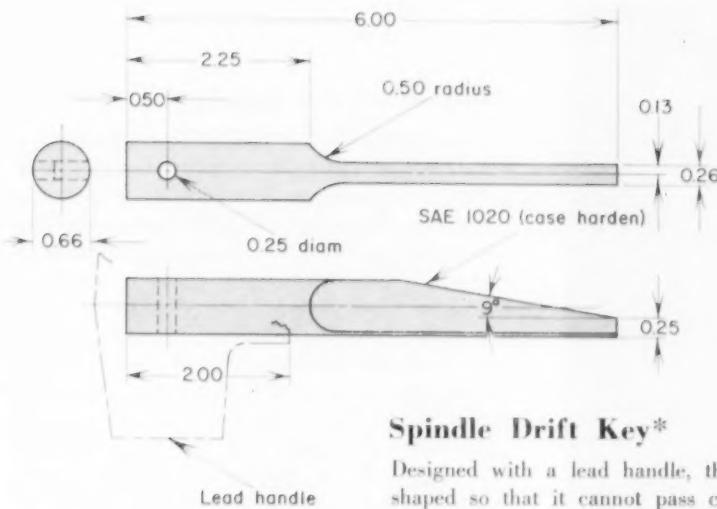
two tool bits can be set with the aid of a micrometer or gage blocks. With the adjustable holder in position, the nut on the cap screw is tightened and the tool is ready for installation.

Tool bits are retained by means of cam locks which are, in turn, held in place by lock pins. Cam locks and lock pins are machined from drill rod, hardened to  $R_C$  50-55. The shank and adjustable holder are of 1045 steel, hardened to  $R_C$  45-50.

The tool was originally designed for cutting grooves in rings. The largest size tool of this type in current use is adjustable to allow a distance of  $4\frac{1}{2}$  inches between tool bits, which is the maximum distance required for the range of operations performed. This tooling arrangement could be applied to a considerable range of parts and setups.

Ragnar Nelson  
Barnes Drill Co.  
Rockford, Ill.





### Spindle Drift Key\*

Designed with a lead handle, the spindle drift key illustrated is shaped so that it cannot pass completely through key slots. The weight of the lead handle eliminates the need for a hammer to free details in a spindle socket. A lead hammer mold can be used in casting the head on the steel drift.

\*Gadgets Contest Entry

Norman F. Snyder  
Saginaw Valley Chapter

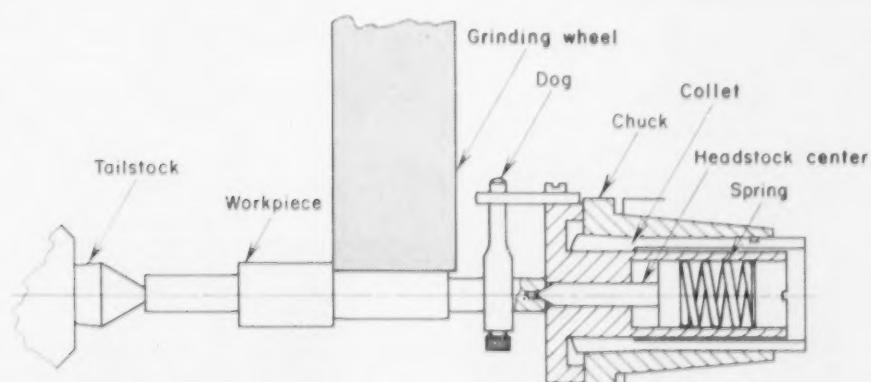
### Spring-Loaded Grinding Center\*

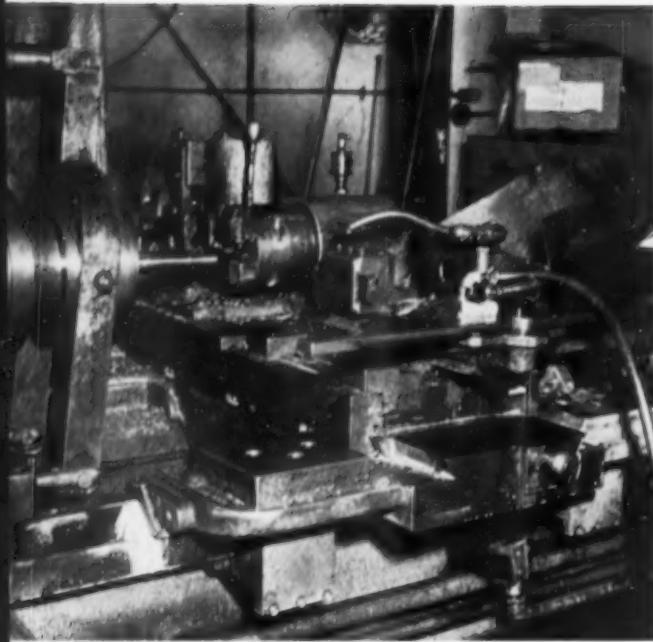
When grinding shoulders on cylindrical parts mounted between centers, shoulder length accuracy is dependent on the accuracy of the centers. The spring-loaded center fixture illustrated, designed for use on an internal grinder, eliminates the need for precision centers. The center itself fits into a fixture body. A spring maintains pressure on the center, holding the workpiece in place.

The end of the workpiece is located against the face of the fixture body, rather than on the center. Each time the part is rechucked for grinding another shoulder, it is located against this same face, insuring consistent results.

\*Gadgets Contest Entry

Klaus E. Schlesinger  
Los Angeles Chapter





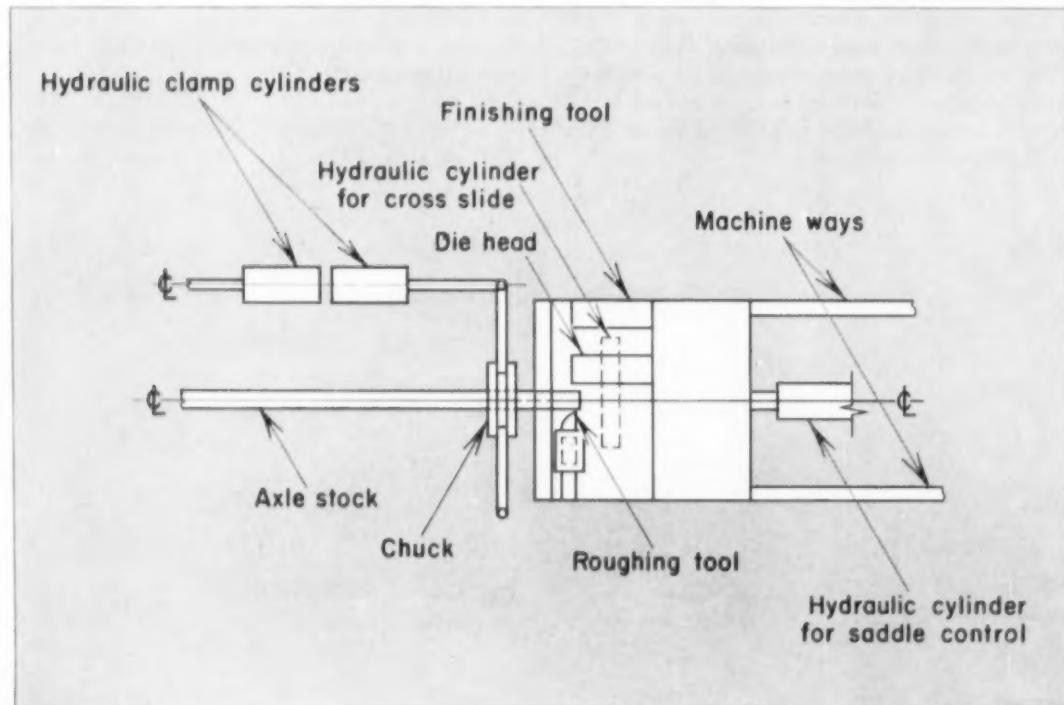
Three-station tooling. Carriage moves tools into position for each operation. Carriage is shown in position for threading.

## Automation for Standard Lathe

Conventional lathes are used as screw machines in the manufacture of axles for automotive equipment in one plant. Three tooling setups are mounted on a single ways carriage so that roughing, finishing and threading operations can be carried out automatically. The sequence is initiated by means of a manual push button. Following each cutting operation, a cam finger trips a microswitch which actuates a solenoid and hydraulic valve, causing the carriage to move until the next tooling setup is aligned with the workpiece.

All cutters have rapid travel up to the point of engagement with the workpiece, after which speed is controlled by a valve and cam mechanism. Work is fed through a hollow direct-drive spindle. Extra large and heavy cross slides provide automatic stops at three points. While this is a special setup, it illustrates how automation can be applied to standard machine tool when production volumes justify the added design and tooling costs.

Thomas A. Dickinson  
Los Angeles, Calif.



# Gadgets

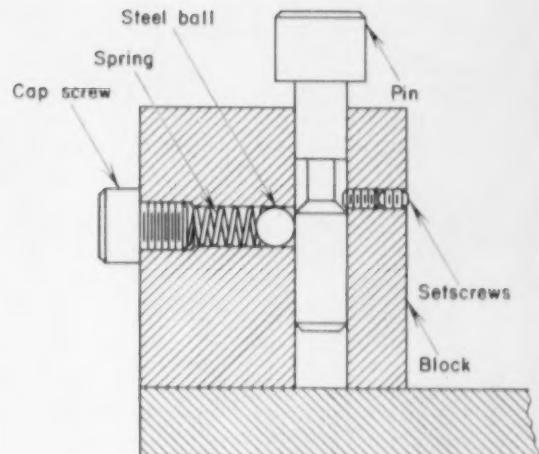
## Height Setting Gage

Milling cutters are usually set to correct height in relation to the work with a set block and shim. This makes it necessary for a setup man to procure a shim and to make adjustments in case the shim is not exactly the required thickness.

The setup device illustrated eliminates the need for shims. It consists of a block which is permanently attached to the milling fixture. A vertical hole in the block accommodates a hardened pin. The shank of the pin is turned for a short length to provide a 45 degree cam surface. The side of the block is drilled to accept a steel ball backed up by a compression spring, both retained by a cap screw. A second horizontal hole in the block holds a setscrew which prevents complete withdrawal of the pin.

To use the setting gage, the pin is pulled up and the machine table is raised until the cutter touches the pin head. As the table is raised further, the pin is pushed down and the steel ball, under pressure from the spring, acts on the cam, causing the pin to snap downward. The table is now at the correct height and the pin is down out of the path of the cutter. A notch below the pin permits a pry to be placed under the head to lift it if necessary.

The gage is not adjustable. Initial adjustment is



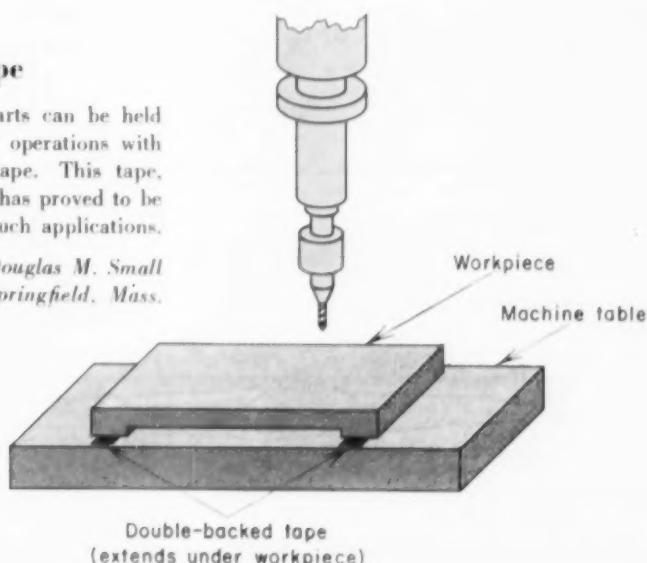
made by grinding off the head of the pin until the correct height is reached. With this device, settings can be accurately made in minimum time. It is especially suited for repetitive production.

*Clint McLaughlin  
Rockaway Beach, New York*

## Holding Parts with Tape

Small metal, wood and plastic parts can be held in position for drilling and other operations with double-backed pressure-sensitive tape. This tape, which has adhesive on both sides, has proved to be extremely useful in the shop for such applications.

*Douglas M. Small  
Springfield, Mass.*

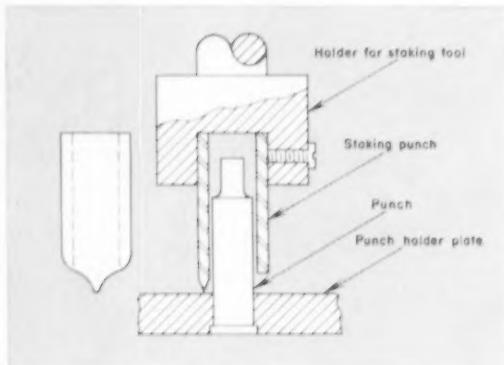


# Gadgets

## Staking Tool

When installing small, round punches in punch-holder plates, minor inaccuracies are sometimes found in the holes. For instance, they may be slightly oversize or tapered. Unless such inaccuracies are corrected, the punch may be loose, leading to breakage in service.

To correct this condition, many toolmakers place



## Improvised Indicating Gage

When a dial-type indicator was needed for checking the diameter of a hole in a small lot of castings, "rush" conditions made it necessary to improvise a gage. The gage body is a length of tubing. A handle at one end of the tube accommodates the shank of a dial indicator. The dial indicator plunger projects into the tube, contacting one end of a rocker arm. At the other end of the tube there is a sliding pin, also in contact with the rocker arm. The rocker arm pivots on a shaft equidistant from both ends of the tube.

To check the diameter of a hole, the end of the

punch in the hole with the punch-holder plate inverted and use a chisel-shaped tool to force the metal in the plate against the punch. This insures a snug fit. Unless some means of holding the punch perpendicular to the punch-holder plate is employed, however, there is always a possibility of installing the punch at an angle.

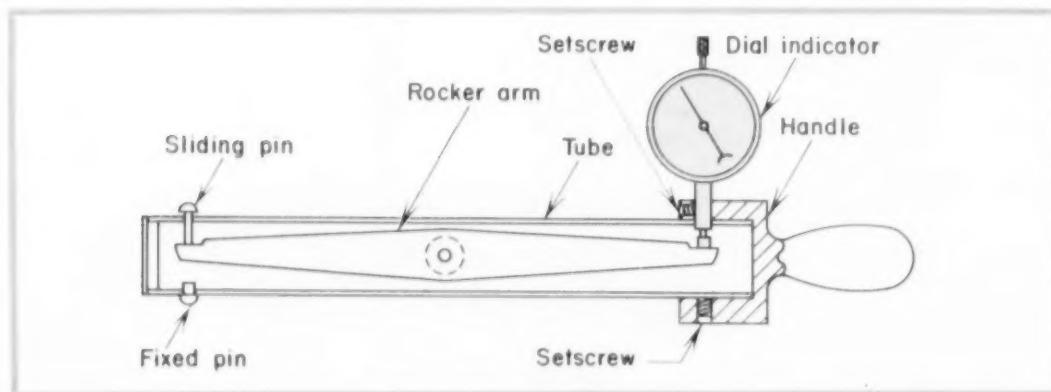
The staking tool illustrated eliminates this danger and does a better job of staking than can be done by manual methods. The tool consists of a hardened tube with a pointed end, as illustrated. The tube ID is such that it is a sliding fit on the punch to be staked. One end of the tube is held in a punch holder for use in a small punch press. By rotating the punch holder and making repeated "hits" with the press, staking in the desired areas is accomplished. This method assures that the punch is always perpendicular to the punch-holder plate.

*Federico Strasser  
Santiago de Chile*

tube containing the sliding pin is inserted in the hole. Movement of the pin, transmitted through the rocker arm, results in a corresponding movement of the dial indicator plunger. Hole size can be read directly on the indicator. The gage is set with a ring, bored to correct size.

This gage performs well in service. While it was designed to solve a specific problem, the same design principle is applicable to other gages.

*Richard Minser  
Cleveland, Ohio*



how to determine

# Production Tolerances

## PART TWO—Statistical Methods and Selective Assembly

By Karl H. Moltrecht\*

240

Robert M. Caddell\*

**Assistant Professors of Mech. Engineering**  
**University of Michigan**  
**Ann Arbor, Mich.**

Although statistical techniques are closely linked with quality control, little use is made of this tool in determining tolerances. This second article of a two-part series on tolerances offers an interesting and highly practical application of such scientific methods.

STATISTICAL METHODS can be an economical and informative tool in developing tolerances of individual components which will be assembled into a complete unit. Although these methods have often been neglected through lack of understanding, they are more readily applied than may at first be imagined.

To understand statistical tolerance analysis, the meaning of two terms must be clearly grasped. The word "average," as may be suspected, is simply the summation of the total number of individual terms, regardless of unit measurement, divided by the total number of terms that are summed. It is a measure of central tendency, or the measurement which might occur most often. It is represented by the symbol  $\bar{X}$  where each measurement is some value of  $X$ .

A second term, not as widely used outside of the field of statistics, is the "standard deviation," usually symbolized by the term sigma,  $\sigma$ . It is simply a measure of the dispersion of individual measures.

both less and greater than the average. In other words, it defines the spread around the average. The mathematical relationships which define these two terms are as follows:

whereas

$\Sigma X$  = sum of all individual values of  $X$

$N$  = number of  $X$  values added together

$\bar{X}$  = average value of  $X$

$\sigma$  = standard deviation

The above description is only intended to explain the meanings of the terms rather than show calculations of  $\bar{X}$  and, particularly,  $\sigma$ .

To show how these statistical tools are used, suppose three parts,  $A$ ,  $B$ , and  $C$  are to be assembled as shown in *Fig. 1*, and that each part contains the basic size and tolerances shown. It can be seen that the over-all variation of the parts after assembly will have a basic size of  $W$  and tolerances of  $\pm t$ , and if all individual parts fall within specifications, the over-all size will be  $6.000 \pm 0.000$  inches.

Thus the variations of the over-all measurement must fall between 6.009 and 5.991 inches. An appropriate question now would be: "what chance exists that these extreme dimensions (i.e., 6.009 and 5.991) would ever occur in an individual assembly?" Before this can be answered, certain assumptions must be made:

1. Each component ( $A$ ,  $B$ , and  $C$ ) comes from a process that shows a normal size distribution or something close to a normal distribution
2. The size of any individual component part is independent of the size of any other component part
3. Parts are selected at random for assembly

\* Senior member ASTE Ann Arbor chapter.

4. The total tolerance spread on each part is equal to a  $6\sigma$  spread and the basic size of each part is the average size that occurs.

In regard to a distribution, this is simply a plot of the measured value versus the number of times the value occurs. For example, suppose the outside diameters of 100 cylinders are obtained and a tabulation of results is made. For simplicity, the sizes are taken to the nearest thousandth of an inch.

A graph of size versus frequency of occurrence is shown in *Fig. 2*. This represents the distribution of sizes as measured. The line drawn through the points may be defined by a mathematical expression. A normal curve is a plot of points which satisfies a particular equation. It is often called a "bell shaped" curve. The principal use of such a distribution is that it affords a means for predicting probability of occurrence of specific sizes on the basis of past performance.

If a distribution is normal and its standard deviation  $\sigma$  known, the area under the curve bounded by limits of  $\bar{X} + 3\sigma$  and  $\bar{X} - 3\sigma$  will be 99.73 percent of the total area under the curve. Since the curve drops off rapidly in either direction as it moves from the center or average, there is less area under the curve for equal horizontal distances. It is seen in *Fig. 2* that the area between  $\pm 1\sigma$  is much greater than the added areas between  $1\sigma$  and  $2\sigma$ . Therefore, there is a much greater chance of a part falling between  $\pm 1\sigma$  limits than between the  $1\sigma$  and  $2\sigma$  limits. Similar analyses could be made for other areas under the curve; thus, the area under the curve can be considered as probability.

To analyze the three-block problem represented by *Fig. 1*, *Fig. 3* will be helpful. The three individual distributions, all assumed to be normal and each having a basic size equal to the average of the distribution, are shown. The tolerance spread of each part has been made equal to the  $6\sigma$  spread per distribution. Since it is also assumed that selection of parts is random for each assembly, the occurrence of size of a part from one distribution is independent of the other distributions. This means

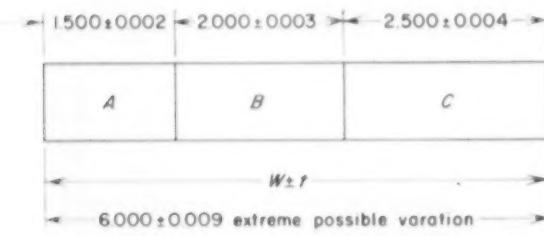


Fig. 1. (above) Representation of a simple assembly comprised of three parts.

Fig. 2. (right) Graphic representation of normal distribution of a single dimension of a production part.

**Correction:** In Messrs. Moltrecht and Cadell's article on production tolerances, in the October issue, there is an error in the first formula on page 85. The equation should read:

$$0.80176X + 0.91613(3X) + 0.40088(2X) = 0.015$$

The remaining formulas published in the article are correct.—Ed.

that if a small part *A* occurs, there is no reason to expect a small part *B* or *C* must also occur. From this the following analysis may be made:

$$\sigma_a^2 = \sigma_A^2 + \sigma_B^2 + \sigma_C^2 \dots \dots \dots (3)$$

where:

$\sigma_A$  is the standard deviation for part *A*

$\sigma_B$  is the standard deviation for part *B*

$\sigma_C$  is the standard deviation for part *C*

$\sigma_a$  is the standard deviation for the assembly that results from combining parts *A*, *B*, and *C*.

This  $\sigma_a$  is dependent upon the other standard deviations and is called the dependent variable. The standard deviations,  $\sigma_A$ ,  $\sigma_B$ , and  $\sigma_C$ , are the independent variables. Since  $6\sigma_A$  is equal to the total tolerance spread of part *A*, in this case, 0.004 ( $\pm 0.002$  inch), the  $\sigma_A$  may be set equal to  $T_A/6$  where  $T_A$  is the total tolerance of part *A*. Similar analysis holds for the other parts. Therefore, Equation 3 may be rewritten as follows:

$$\frac{T_a^2}{6} = \frac{T_A^2}{6} + \frac{T_B^2}{6} + \frac{T_C^2}{6} \dots \dots \dots (4)$$

This implies that the variations of the assembly will also show a normal distribution and the standard deviation is equal to the total tolerance spread divided by 6. Since each term has the same denominator, Equation 4 may be rewritten as follows:

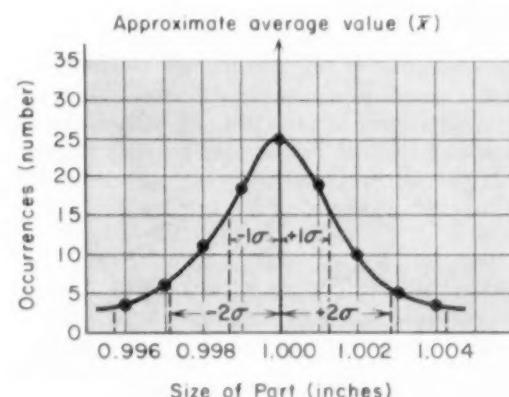
$$T_a^2 = T_A^2 + T_B^2 + T_C^2 \dots \dots \dots (5)$$

If the bilateral tolerances of individual parts are used, the assembly tolerance will also be bilateral. Thus:

$$T_a = (0.002)^2 + (0.003)^2 + (0.004)^2$$

$$T_a = \sqrt{0.000029} = 0.0054$$

From a statistical viewpoint, in view of the assumption



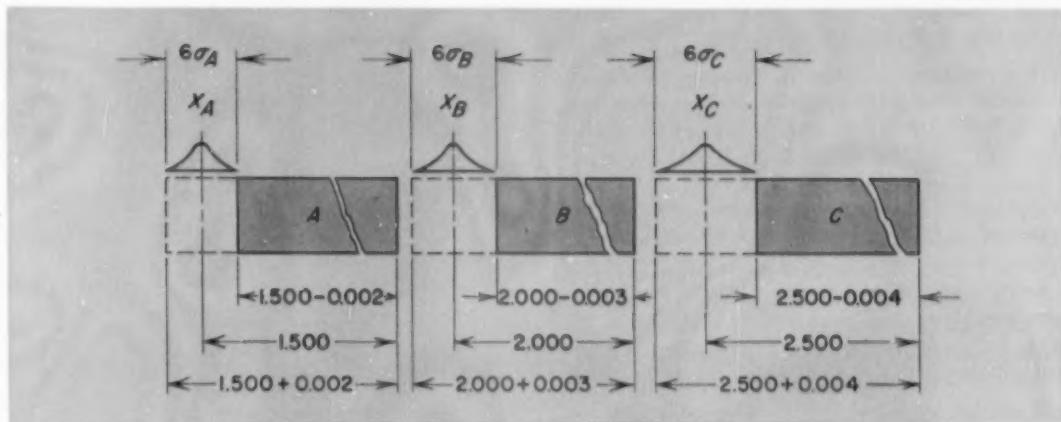


Fig. 3. Statistical analysis of assembly and component part tolerance problem presented in Fig. 1.

tions made, the values of  $W$  and  $t$  in Fig. 1 would be  $6.000 \pm 0.0054$  rather than  $6.000 \pm 0.009$  as first calculated arithmetically.

With this illustration in mind, the more typical industrial problem posed in the previous article, Part I, THE TOOL ENGINEER, October 1957, will be analyzed statistically. Using the path equation and extreme conditions as stated, the following relationship results:

$$\begin{aligned}
 & - \left[ \frac{0.500 + 0.001}{2} \right] + \left[ \frac{0.505 - 0.002}{2} \right] \\
 & + (2.00 - X) + \left[ \frac{0.380 - 0.002}{2} \right] \\
 & - \left[ \frac{0.375 + 0.001}{2} \right] - (2.00 + X) = 0
 \end{aligned}$$

Basic sizes and tolerances are not required. This equation reduces to:

$$\begin{aligned}
 & -0.500 - 0.001 + 0.505 - 0.002 + 4.000 \\
 & -2X + 0.380 - 0.002 - 0.375 + 0.001 \\
 & -4.000 - 2X = 0
 \end{aligned}$$

Combining basic sizes and removing all tolerances to the opposite side of the equation gives:

$$\begin{aligned}
 & +0.010 = 0.001 + 0.002 + 2X + 0.002 \\
 & +0.001 + 2X
 \end{aligned}$$

At this point, an arithmetic approach would show  $X$  to equal 0.001, which checks with the solution in Part I of this article.

In actual production, the individual dimensions on the parts will vary independently within the tolerances specified; thus, these tolerances,  $\pm 0.001$ ,  $\pm 0.002$ , and  $\pm X$ , are the independent variables. The total clearance between the pins and holes will result from variations of the individual dimensions and is, therefore, the dependent variable. The figure  $\pm 0.010$  in the above equation is the total average clearance that occurs when all dimensions are basic. Thus, the clearance in any assembly will vary between zero and 0.020 inch. In this example the

unknown quantities are two independent variables,  $\pm X$  on each center distance. The resulting relationship is comprised of seven terms: one dependent variable ( $\pm 0.010$ ) and six independent variables ( $\pm 0.001$ ,  $\pm 0.001$ ,  $\pm 0.002$ ,  $\pm 0.002$ ,  $\pm X$ , and  $\pm X$ ).

Applying the basic statistical equation listed previously: Dependent variable equals the square root

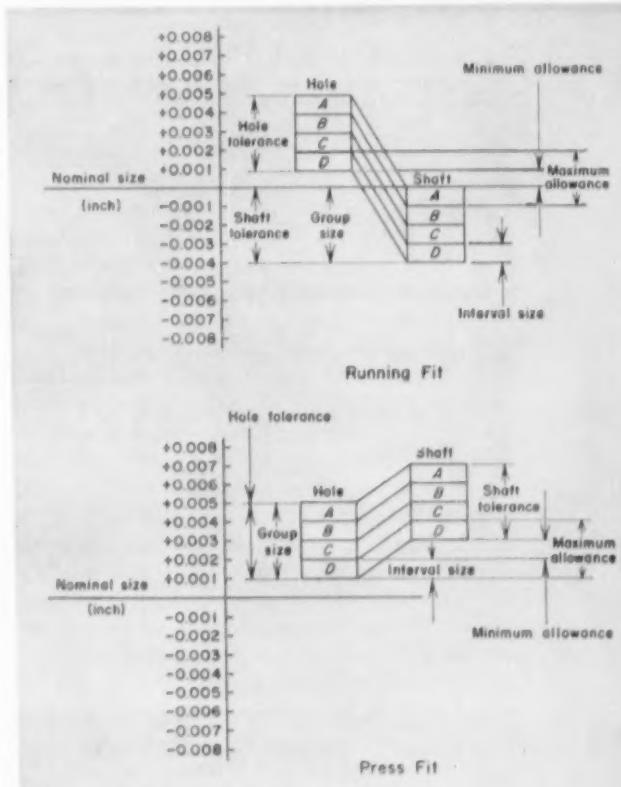


Fig. 4. Selective assembly systems for application to running fits and press fits.

of the sum of the squares of the independent variables, or:

$$\begin{aligned}(0.010)^2 &= (0.001)^2 + (0.002)^2 + (2X)^2 \\ &+ (0.002)^2 + (0.001)^2 + (2X)^2 \\ \therefore 0.000100 &- 0.000010 = 8X^2 \\ X &= \pm 0.0033\end{aligned}$$

This example indicates that a center distance tolerance of  $\pm 0.001$ , as determined arithmetically, is tighter than necessary.

To analyze a more complicated problem, the dimensions given in Figs. 4 and 5, Part 1, will be used. Values for tolerances  $a, b, c, d, e$  and  $m$  were found by the path equation, which can be resolved

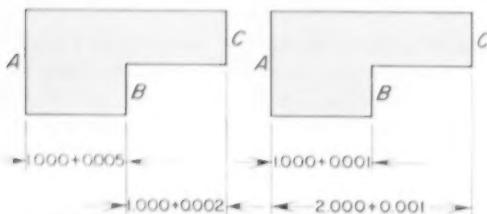
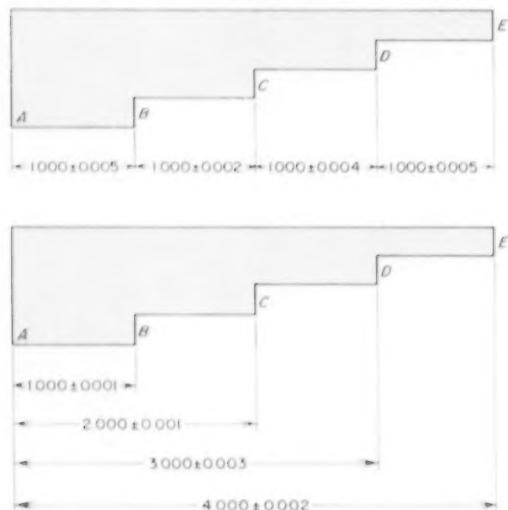


Fig. 5. Reference surfaces, *a* (left) as available from original part design; *b* (right) as revised.

Fig. 6. Transfer of series of dimensions shown (top) as designed and as modified by tool engineering (bottom) for production use.



to the form:  $0.91613a + 0.91613b + 0.91613c + 0.40063d + 0.40063e + 0.801176m = 0.015$  inch.

Suppose all tolerances are equal (i.e.,  $a=b=c$  etc.). To simplify the arithmetic, each multiplier is rounded off to the third decimal place. Then this

equation becomes:

$$\begin{aligned}0.916a + 0.916a + 0.916a + 0.401a + 0.401a \\ + 0.802a = 0.015\end{aligned}$$

The dependent variable in this case is the 0.015 inch tolerance.

The statistical approach is to square each term, thus:

$$\begin{aligned}(0.916a)^2 + (0.916a)^2 + (0.916a)^2 + (0.401a)^2 \\ + (0.401a)^2 + (0.802a)^2 = 0.015^2 \\ 0.84a^2 + 0.84a^2 + 0.84a^2 + 0.161a^2 + 0.161a^2 \\ + 0.643a^2 = 0.015^2 \\ 3.485a^2 = 0.000225 \\ a^2 = 0.0000645 \\ a = \pm 0.008 \text{ inch}\end{aligned}$$

Consequently, all tolerances ( $a, b, c, d, e$ , and  $m$ ) are set equal to  $\pm 0.008$  inch. This compares with the  $\pm 0.003$  inch found by an arithmetic approach, again showing that this tolerance can be opened up.

There are numerous combinations of numbers that could be assigned to the tolerances, and, when squared, be equal to 0.015 squared. The most logical approach is to assign any necessary or known tolerances before squaring and distribute the remaining tolerances accordingly. If no information is available, a good starting point is to set each tolerance equal to every other tolerance, then make adjustments that seem warranted.

As a final caution regarding the application of statistical theory to the assigning of tolerances, assumptions made initially must be kept in mind. These must be verified in practical situations. Where distributions are not normal, other factors must be determined to relate  $\sigma$  to the tolerance spread. That is  $\sigma = T/6$  holds for normal distributions; values other than 6 should be applied for nonnormal distributions. A discussion of such distributions, which sometimes occur, is beyond the scope of this article. In any case, these illustrations indicate that for many applications, a straight arithmetic approach based upon a combination of extreme dimensions will produce tolerances that are tighter than is necessary.

#### Selective Assembly

Occasionally functional requirements are so strict that even the application of statistics results in machining tolerances that are not economical. In this event serious consideration should be given to the application of selective assembly procedures. In Fig. 4 two selective assembly systems are shown, one for a running fit and the other for a press fit. In establishing such a system the following procedure should be followed.

1. Establish maximum and minimum allowance, based on functional requirements of the part.
2. Determine method of machining the mating parts. This will establish their position relative to the basic size.

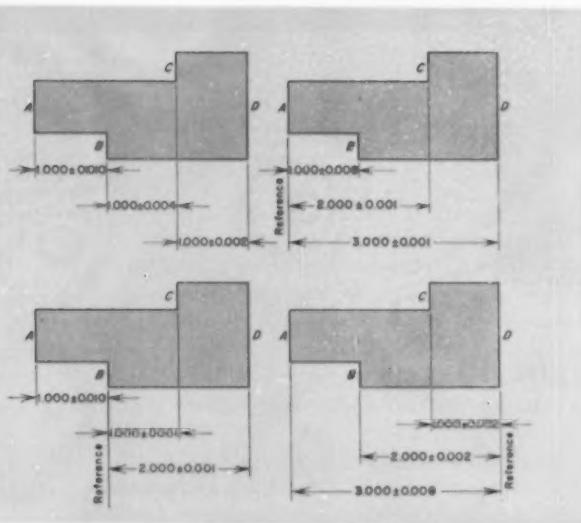


Fig. 7. Choices possible in typical part for reference surfaces. Original dimensioning is shown at upper left; optimum dimensioning at lower right.

3. Determine the interval size as follows:  
Subtract the minimum allowance from the maximum allowance. Multiply the resulting figure by one-half.
4. Determine the group size. This will usually depend upon the tolerance obtainable from the machine that is capable of producing the least accuracy when machining the two parts. It is usually equal to the maximum accuracy that this machine can produce at a reasonable cost. If so desired, the group size may be enlarged but it should never be decreased.

Correctly applied, selective assembly assures 100 percent interchangeable assembly for all parts within a given interval size, thus assuring a constant flow of product out of the plant and relatively low assembly costs. By increasing the acceptable tolerance range, machining costs are reduced. It must be recognized that inspection costs and materials handling costs are usually increased when this system is installed. This suggests that a careful study be made before selective assembly is decided upon.

#### Transfer of References

A common tool engineering procedure, the transfer of references, provides more acceptable reference or locating surfaces from a practical machining point of view, than those available in the original design and specifications. A fundamental rule that must be adhered to in this case is:

When transferring the reference of a dimension, the sum of the new tolerances that affect this dimension must not exceed the tolerance of the original dimension.

Again, the application of this rule can be best explained by illustration. The part shown in Fig. 5a has the original dimensions as provided by the

design engineer. In Fig. 5b the part is dimensioned to utilize surface A as the reference surface for machining purposes. In order to maintain the original tolerance between B and C ( $\pm 0.002$ ), the sum of the tolerances between A and B, and A and C must not exceed the original tolerance between B and C. In Fig. 5b if AB is at the lower limit and AC is at the upper limit their dimensions would be 0.999 inch and 2.001 inch, respectively. BC would become 1.002 inch which is the maximum dimension permissible. Any increase in the tolerance of AB or AC, without a corresponding reduction in the other, would cause BC to exceed its upper limit. If the upper limit of AB and the lower limit of AC are considered, BC could not be less than 0.998 inch which satisfies the original specifications.

A series of dimensions are shown in Fig. 6. Analysis will show that two different answers are possible if the reference is to be transferred to surface A. The analysis is made in the order shown. When starting from E:

$$\begin{aligned} AE &= 4.000 \pm 0.0025 \text{ inch} \\ AD &= 3.000 \pm 0.0025 \text{ inch} \\ AC &= 2.000 \pm 0.0015 \text{ inch} \\ AB &= 1.000 \pm 0.0005 \text{ inch} \end{aligned}$$

When starting at C:

$$\begin{aligned} AC &= 2.000 \pm 0.001 \text{ inch} \\ AB &= 1.000 \pm 0.001 \text{ inch} \\ AD &= 3.000 \pm 0.003 \text{ inch} \\ AE &= 4.000 \pm 0.002 \text{ inch} \end{aligned}$$

The sum of the resulting tolerances is the same,  $\pm 0.007$  inch. This illustrates that several choices of tolerances are available when transferring references. There is usually an optimum selection, however, that is more compatible with machine tool capabilities and economical manufacturing. In the example cited the minimum tolerance is  $\pm 0.001$  inch for the second case, whereas, a minimum tolerance of  $\pm 0.0005$  inch is required in the first case.

A situation sometimes arises where more than one reference surface is available to choose from when machining a part. In this event, the reference or locating surface should be chosen which provides the largest tolerance for the surfaces to be machined. Such a situation is illustrated in Fig. 7. It is assumed in this case that surface C is to be machined and that the part can be located from surfaces A, B, or D, as shown. Applying the fundamental rule of the transfer of references, the dimensions resulting from the selection of each of the reference surfaces are shown. These indicate that if surface D is used as the reference surface the over-all tolerances, considering all surfaces, will be optimum and should afford lower machining costs.

From this discussion it is evident that there are a variety of methods beyond conventional practice, which are available to the tool engineer in dealing with today's complex tolerance problems.

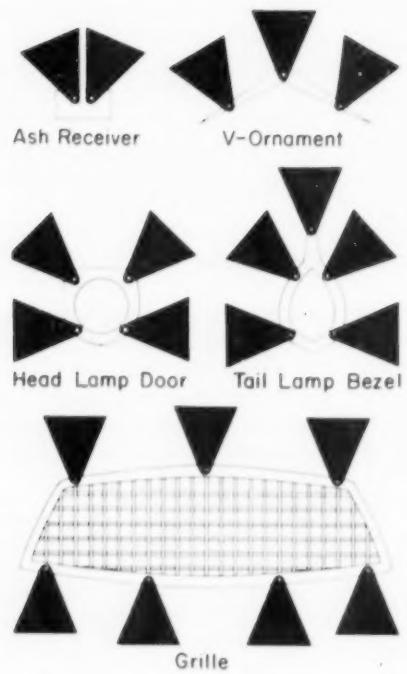
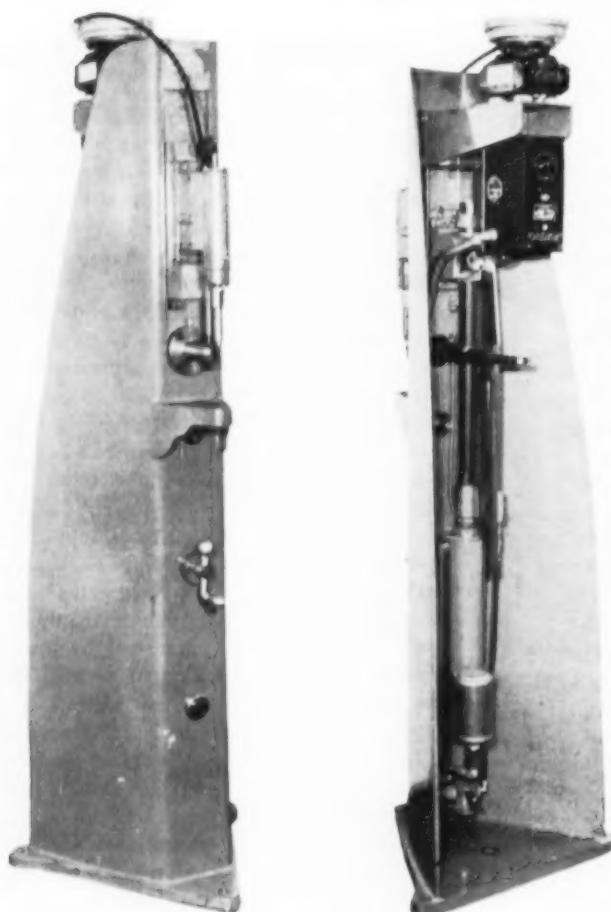
# designed for **PRODUCTION**

## **STUD DRIVER** Operates in Tight Places

Threaded studs and rivets are widely used to fasten die castings but their placement has been a time-consuming operation. This machine has been designed for single use and has been shaped so that several machines can be grouped in a pattern. Minimum stud spacing, within a group of machines

having a fixed pattern, is 2 inches between centers.

Studs are loaded in a vibratory hopper at the top of the machine, which was developed by Studrive, Inc., and feed through a flexible tube to the shuttle. When the workpiece is in position, the leadscrew-chuck unit advances and turns the stud into position. The leadscrew is turned by a gear system that is activated by a rack. The rack is powered by an air cylinder.

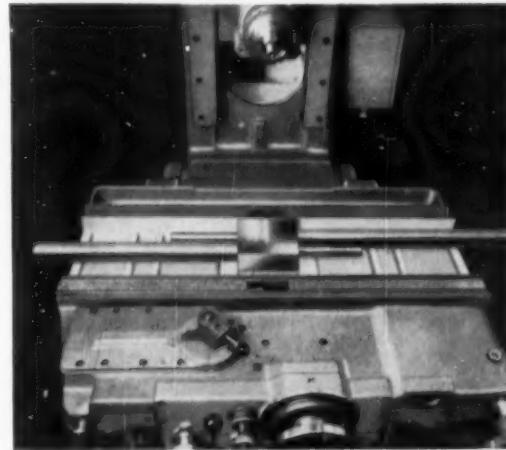


## Surface Grinder Designed for Precision

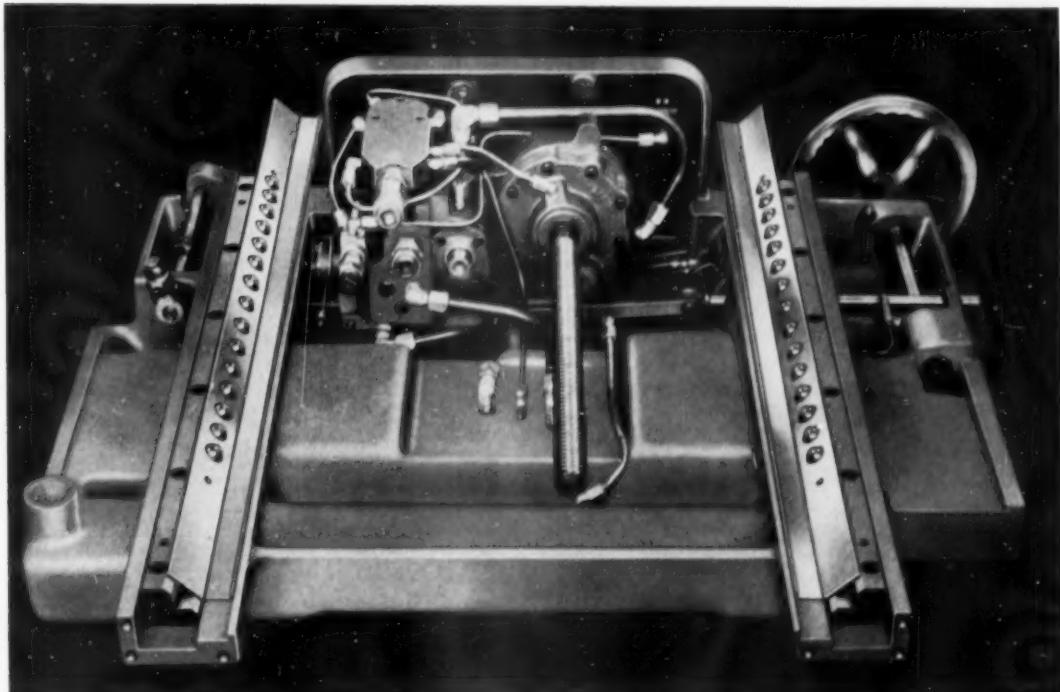
Considerable attention has been paid to possible sources of heat and inaccuracy in the design of a line of surface grinders. The table is operated by twin rams to reduce heat build-up and the hydraulic power system is operated at low pressure, 200 psi. Normal temperature rise in the system is only about 20 F.

The coolant system is located outside the machine to prevent heat transfer from that source. The hydraulic power unit, which is mounted on casters for maintenance ease, is not painted. Heat can dissipate easily from the unpainted surfaces, while the inside of the grinder is painted white to reflect heat back into the cooling air stream. The power unit is cooled by a large air flow, which exits up the column.

Oil cushions absorb shock at the end of each stroke. Since each precision-ground ram is a piston in this grinder, developed by the Abrasive Machine Tool Co., there can be no out-of-line piston rods.



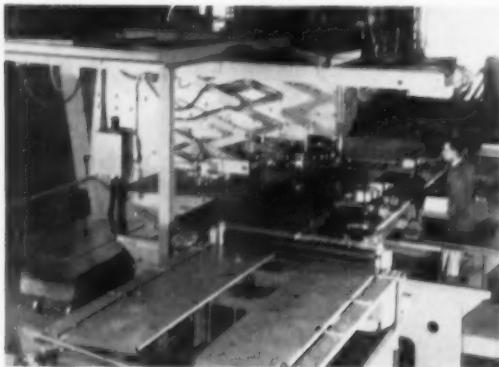
**HYDRAULIC SYSTEM** for this surface grinder has been designed for cool operation. For example, there are two hydraulic cylinder rams to actuate the table, here removed. Each ram is under pressure only half the time. During the rest of the cycle, it cools. This prevents build-up of heat.



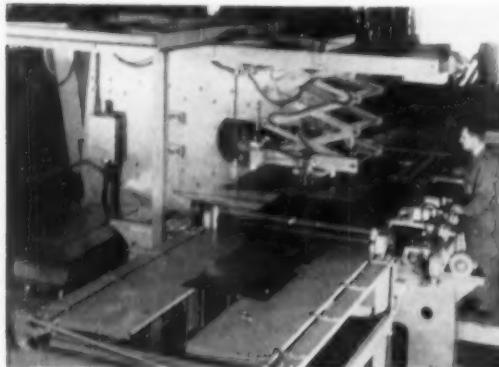
**SMOOTH CROSSFEED** is assured by mounting the saddle on  $\frac{3}{4}$ -inch-steel pre-loaded ball bearings, running on square, hardened-steel ways. A hydraulic motor rotates the precision crossfeed screw for rapid saddle traverse when dressing the wheel.

# DESIGNED FOR PRODUCTION

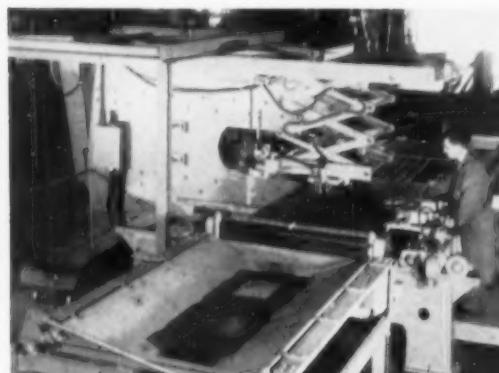
## TURRET PRESS AND AUXILIARIES punch odd shapes rapidly



WHILE operator controls punching of one small sheet, loader stands by with next large sheet held by a pair of 14-inch vacuum cups.

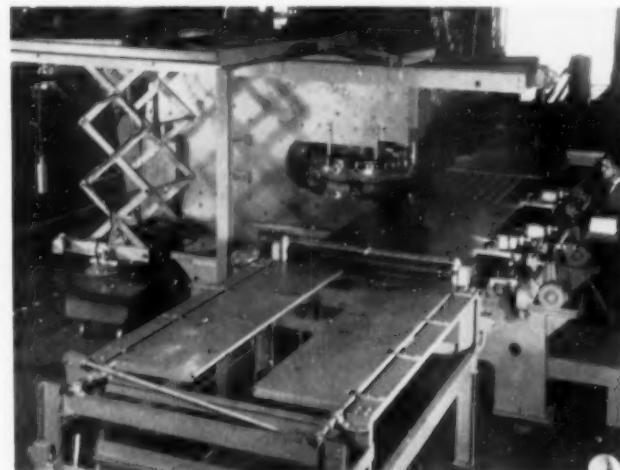


SMALL sheet is partially unloaded by rollers onto stacker unit as the next sheet approaches the loading station on the table.



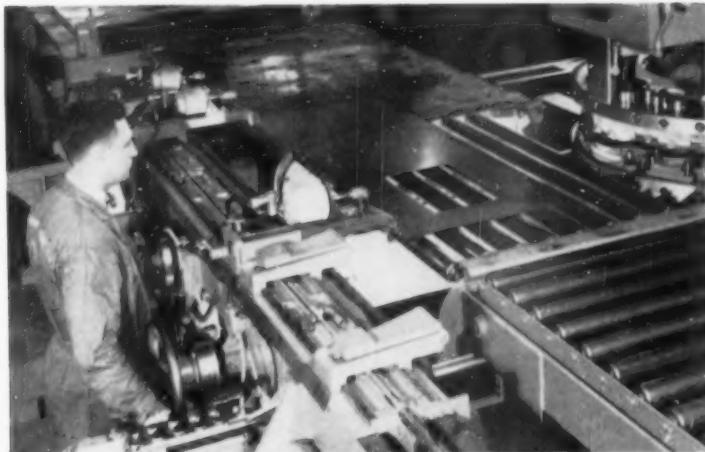
Through use of an automatic loader-unloader-stacker unit and a turret punch press having a direct measuring table and gage, considerable time can be saved when producing a variety of holes in large metal sheets. Success of this equipment is achieved through simple location of openings, and movement of materials during piercing time.

With this equipment, developed by the Wiedemann Machine Co., layout and setup steps are unnecessary. Hole types and sheet positions are listed on a chart, which makes only one set of data visible to the operator at any time. Each stroke of the press advances the chart one space. Large openings are formed by multiple strikes of small punches.



SHEET LIFTER picks up next small sheet while large sheet is run to stops and clamped on the movable cross slide.

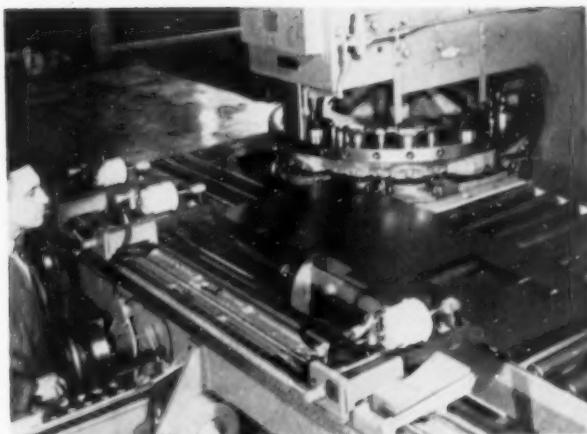
STACKER centers small sheet and drops it onto the stack (left) as the large sheet is released at the loading station on the table. Operator then takes over control.



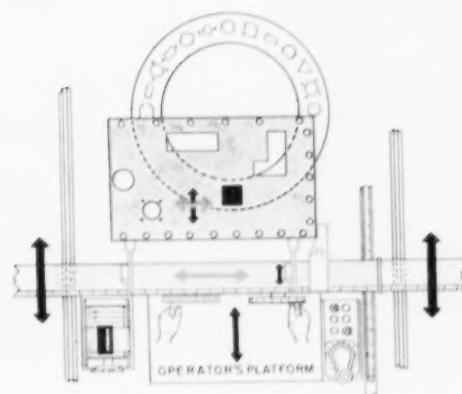
WORK supporting rolls are shown between tables on the direct measuring gage. These rollers help in handling thin or small sheets.



ROLLS, which are linked together follow semi-circular track and fall downward toward operator as the table approaches press.

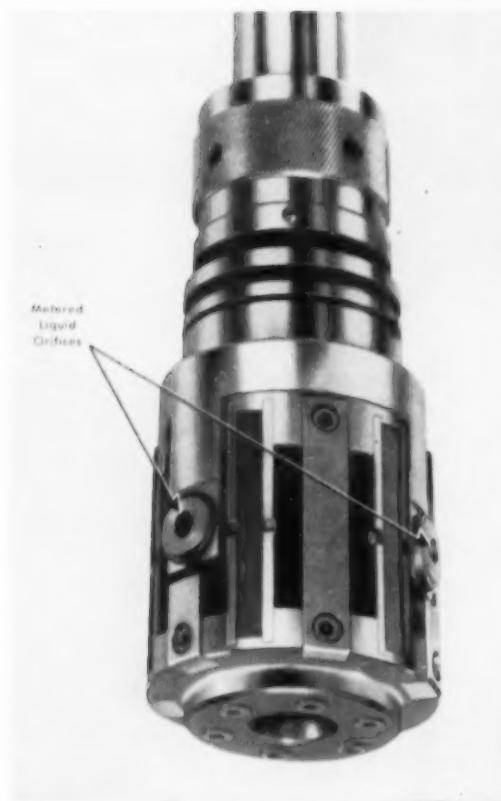


SCRAP pieces are removed by depressing the right table rollers to form a gravity conveyor. The work-piece is then unloaded and stacked to the left.



OPERATOR'S TABLE rides on rails so operator is always as close to the operations as possible. Arrows indicate table and platform movements. Sheet is located under punches by turning convenient hand-wheels to give correct X and Y coordinates.

# DESIGNED FOR PRODUCTION



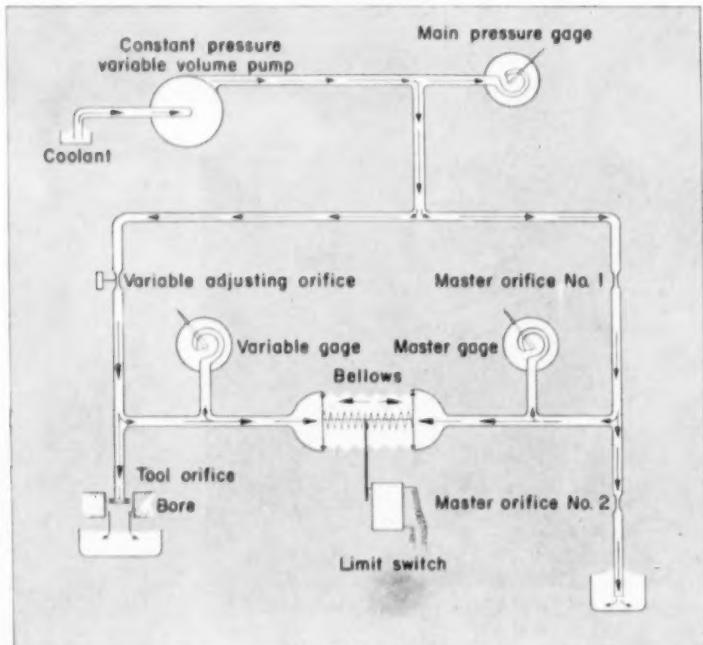
**HONING TOOL** has orifices through which liquid is forced. When the back pressure of the liquid drops to a preselected value, the bore is to size and the honing operation is automatically stopped.

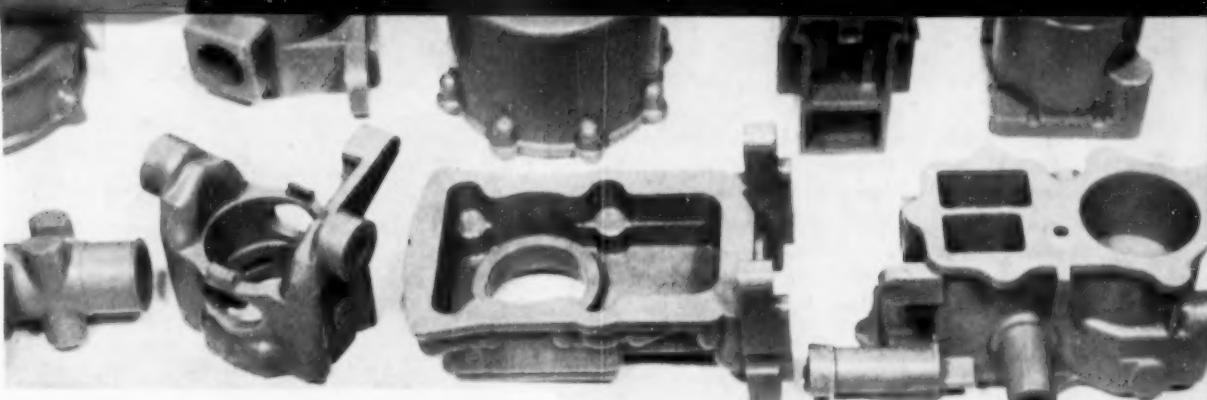
**BACK PRESSURE**, created by forcing coolant between the tool and wall of the work-piece bore, causes the bellows to expand. As the bore is enlarged, the bellows relaxes. At the proper bore size, the back pressure balances the setting on the master gage and the limit switch is activated to withdraw the tool.

## HONED BORE SIZE controlled by liquid pressure

Honed bores can be automatically gaged over their full length as honing progresses if a liquid is introduced through the tool. Actual sizing is accomplished by metering the liquid through orifices in the tools and sensing the back pressure. In this system, developed by Barnes Drill Co., initial tripping of the limit switch does not immediately stop the cycle. The tool goes through one more complete stroke. If the bore is not to size at any point, the limit switch is untripped and honing continues until the entire bore length is to size.

This method of size control introduces several additional advantages. Since coolant is flooded over the cylinder walls at the most critical point during the honing cycle, heat build-up is prevented. The coolant also provides continuous flushing that increases stone life and improves surface finish.





# engineering properties of pattern waxes

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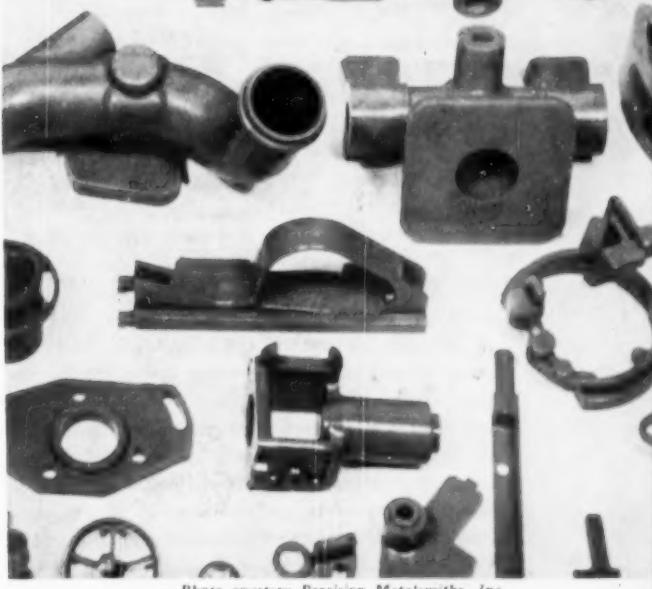
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New York University

Alexander Saunders

Alexander Saunders and Co.  
New York, N. Y.

Now that precision investment casting again ranks as a standard production process, considerable effort is being expended in improving it. With the overall considerations established, attention is now focused on details. The authors discuss pattern waxes and their selection.



—Photo courtesy Precision Metalsmiths, Inc.

Fig. 1. Variety of typical wax patterns used in precision investment casting indicates the ranges of size and complexity now encountered.

DESPITE THE FACT that the performance properties desired in a wax for investment casting patterns have been rather completely described, little quantitative engineering data on such performance have been reported. Such data, based on standard tests of the necessary physical properties, would be helpful in delineating performance parameters and establishing desired specifications.

Some data for a group of commercial pattern waxes, obtained during an investigation aimed at the development of a superior low-cost pattern material, will be discussed. It is hoped that these data will lead to further study and the establishment of specifications based on desired performance.

Any useful wax composition is a compromise that has several but not all of the desired properties listed in TABLE 1. For example, maximum toughness

Based on a paper presented before the Investment Casting Institute.

Table I—Desired Properties for Pattern Waxes

Injection	Investment of Pattern
Flowability at low temp.	Good wettability by investment slurry
Extended melting range, wide "mushy" range	
Minimum weight loss or viscosity increase on prolonged heating	
Solidification	Pattern Melting
Rapid solidification	Minimum penetration of investment by molten wax
Low shrinkage	Minimum volumetric expansion to flow point
Minimum spread between flow temp. and temp. of proper handling properties	Minimum ash content
Mold Release	Handling and Storage
Easy mold release	High strength
Smooth pattern surface	Toughness
Minimum tack	Hardness
Toughness	Resiliency
Resiliency, without permanent deformation	General
	Uniform composition
	Low toxicity
	Low cost

and strength are usually associated with high injection temperatures and longer dwell times; extremely hard compositions are often brittle, and many of the more desirable properties are found only in higher cost raw materials. To intelligently select pattern waxes for the many ranges of size and intricacy involved in production, *Fig. 1*, requires an understanding of the interrelationships of properties and knowledge of how such properties can be obtained.

Six commercial waxes (see box) were tested during this study. Test apparatus and procedures were developed for relating volume change, hardness and viscosity to temperature, determining tensile strength at room temperatures and establishing cooling curves. Test procedures will not be outlined here.

**Viscosity:** Resistance to flow of molten wax is probably the most important factor influencing the temperature at which the wax is injected into a mold. Knowledge of the relationship between viscosity and temperature also indicates the extent of the "mushy" range. Results of the viscosity tests are shown in *Fig. 2*. As references, the viscosity of water at room temperature is about 1 centipoise; that of pure glycerine is about 629 centipoise; while that of castor oil is 451 at 30 C and 16.9 at 100 C.

The question of injection temperature is an important one. Over the range of injection temperatures used, it is important that the wax be fluid enough (low viscosity) to be pumped into the mold without excessive pressures and fill small, narrow interstices and crevices. At the same time, the wax should be viscous enough so that it does not leak past the piston. The lowest practical injection tem-

#### WAXES TESTED

- Wax No. 1—Widely used commercial wax.
- Wax No. 2—Said to have good surface finish but considered expensive.
- Wax No. 3—Extremely hard wax said to fracture rather than distort.
- Wax No. 4—Widely used commercial wax believed based on hydrogenated castor oil.
- Wax No. 5—An early jewelry wax said to contain a high proportion of carnauba wax.
- Wax No. 6—A low-cost wax said to contain a high plastic content.

perature should be selected since this will result in a minimum dwell time for the molded pattern.

In the range of 140 to 160 F, covering the common injection temperatures, the tested waxes fall into two main groups: those with a viscosity of several thousand centipoises or lower, and those in the range of 8 to 10 thousand centipoises or higher. It is believed that the behavior of the low-viscosity group is characteristic of waxes, whereas that of the higher viscosity group represents wax mixtures with substantial resin content.

Wax No. 6 is an interesting variation, experiencing a sharp drop in viscosity at about 190 F due to

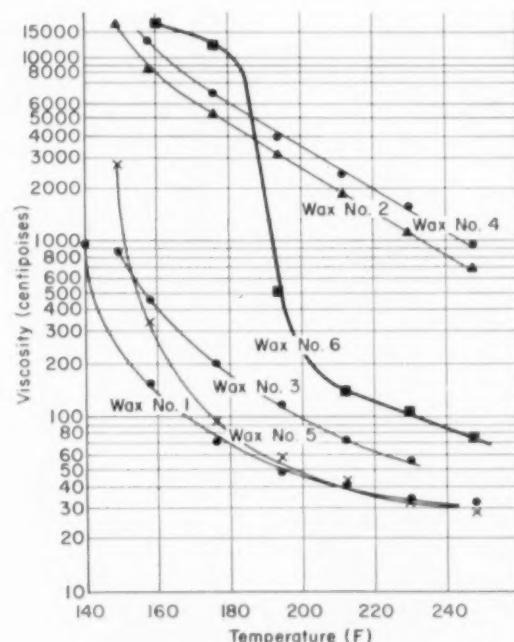


Fig. 2. Viscosity curves obtained for the six pattern waxes investigated show considerable variation.

melting of a solid phase. At about 140 F (extrapolated) several of the mixtures reach viscosities of 20,000 centipoises, which may represent a practical limit on injection viscosity.

The maximum viscosity that can be used in practice, and how much this is influenced by factors such as the shape of the die, or other physical properties of the wax, such as surface tension, has not yet been clearly established.

**Hardness:** Handling properties and mold release temperatures can be determined in large measure by the hardness of a pattern wax. Hardness tests were made on an asphalt penetrometer by determining the penetration of a No. 14 needle under a 100-g load after 5 seconds. Results are shown in *Fig. 3*.

At room temperature, about 74 F, all of the waxes tested have hardnesses below 10. Two of them, however, are above the 6-8 range of values that have been suggested as desirable. At 90 F, a temperature often reached in foundries in the summer, these same two waxes have dropped in hardness to 13 and 14, which would appear to be definitely undesirable.

For early removal from the mold, high-temperature hardness is important. Up to 100 F, the waxes all have hardnesses of 17 or better. These materials have all been successfully withdrawn from commercial molds at this temperature. However, at higher temperatures, wax No. 6 shows a sharp drop in hardness. Handling of patterns made from this wax, on removal from the mold at temperatures higher than 104 F, is to be avoided.

On the other hand, a sharp rise in softness at temperatures above 110 F gives indication that the wax will exhibit plastic flow under pressure, lead-

ing to low injection temperatures. The important temperature differential is the one between injection temperature and that temperature at which the pattern is hard enough to handle.

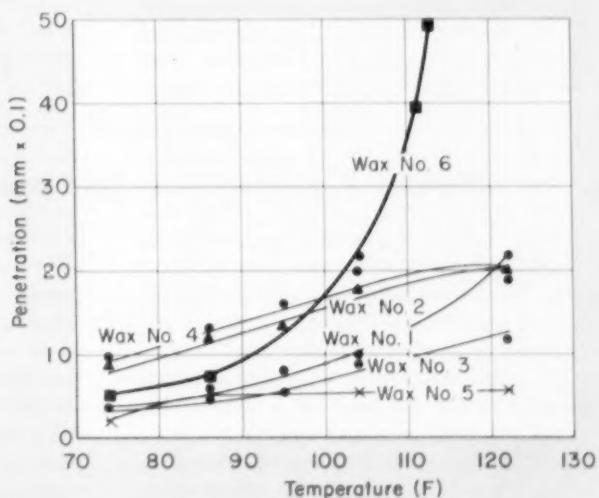
The precise combination of temperature and pressure to give a minimum dwell time is determined by the particular pattern and the physical properties of the wax. At present, these values cannot be predicted but must be determined experimentally. The most important factor determining when a pattern can be released from the mold is the flowability of the wax. Since this property is related to hardness, it would be interesting to see what the relationship is. This would be easy because hardness is a property that can be measured easily.

A useful test would be the American Dental Assn. Specification No. 4 for flow properties of inlay waxes. Cylindrical specimens are prepared and subjected to a load of 2 kg for 10 minutes at various temperatures. The flow is measured as the percentage change in length. According to the specification, the flow should be at least 50 but not more than 75 percent at 43 C, not greater than 5 percent at 38 C and 1 percent or less at 37.5 C.

**Volumetric Expansion:** Shrinkage and expansion of a pattern wax, with respect to temperature, become increasingly important as the requirements for accuracy are raised for the cast part. Results of the expansion tests are shown in *Fig. 4*. Deviations between the different waxes are more pronounced at higher temperatures.

There are two important volume changes for any pattern material. The first, for injection, is the contraction of the wax from the "flow point under pressure" temperature to room temperature. This is

**Fig. 3. Hardness curves resulting from tabulating the penetration of a standard needle into a sample of the wax, at a specific temperature, after an elapsed time of five seconds.**



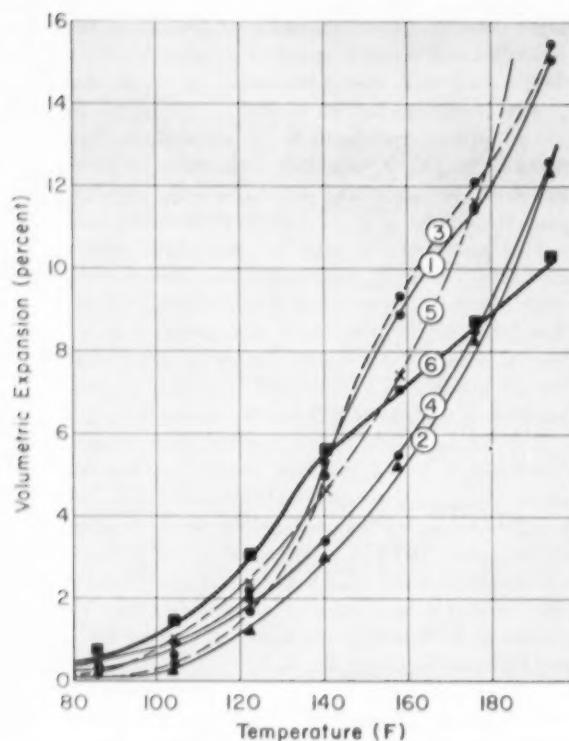


Fig. 4. Volumetric expansion curves show how much the pattern will shrink during the dwell period and how much it will expand as it is melted out of the mold, both being critical periods.

important because the wax can continue to flow during a major portion of the dwell period. The second, for pattern melting, is the expansion of the wax from room temperature to the temperature at which it flows from the mold. The extent of this expansion is important because, if too large, it could cause distortion in the investment shell.

A wax capable of low-temperature injection has a distinct advantage because the total volume change experienced by the pattern is lower. With processes of the Glascast shell type, pattern mate-

Table 2—Tensile Strength of Waxes at Room Temperature

Wax No.	Tensile Strength (psi)
1	217.2
2	176.0
3	343.9
4	286.5
5	437.6
6	245.0

rials having low expansion characteristics should be used. Such products are presently under development in several laboratories.

**Tensile Strength:** Handling properties of a pattern wax can be predicted from its room-temperature tensile strength. Strengths of the six waxes tested are listed in TABLE 2.

Tensile strengths of these waxes vary considerably. For adequate handling characteristics, tensile strength should not be less than 200 psi. With higher strength, handling and mold release are facilitated.

**Cooling Characteristics:** A set of cooling curves was obtained by placing molten wax in a Dewar Flask, inserting a thermocouple attached to a recording potentiometer, and plotting the values. In general, the slopes of the cooling curves, which indicate rates of cooling, were fairly similar for all the waxes tested. There were, however, rather wide variations in the extent of the "slushy" range, the condition between a clear fluid and the solid state. Most foundries favor a wide slushy range.

The pattern waxes tested represent various compromises between desired properties and cost. Not one of them could be considered as a "general purpose" wax. By testing available waxes, however, individual foundries can select those that meet specific requirements at prices that are not excessive. There is still much to do, unfortunately, in correlating physical properties of pattern waxes with optimum foundry practice.

## Nylon Coating for Increased Wear Life

**C**ONSIDERABLE experience seems to prove that a nylon coating provides significantly increased wear life for operating metal parts. One of the successful coating processes, invented in Germany and licensed in this country to Polymer Processes, Inc., involves dipping preheated parts into a bed of finely divided dry coating powders, fluidized by ascending currents of gas or air in specialized equipment.

In this Whirlclad method, the preheat temperatures of objects to be coated are above the melting point of the coating powders. Consequently, the

powders immediately heat fuse onto part surfaces.

Adoption of nylon-coated guide bar pins on a knitting machine by The Narrow Fabric Co. increased pin life by 500 percent. During machine operation the traverse bar moves back and forth over the supporting pins as often as 700 times per minute. Daily oiling prolonged part wear to only about three months and resulted in considerable waste from stain. Now in this equipment nylon-coated pins have been operating for about 15 months without appreciable wear.

# *barrel finishing operation improves*

# **FATIGUE STRENGTH**

## **...of jet engine parts**

By **J. D. Marble**

and

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**Faced with the problem of generating smooth finishes on jet engine parts at low cost, General Electric engineers tested seven different finishing processes. The authors describe the tests and point out an important relationship between surface finish and fatigue strength.**

**S**MOOTH SURFACE FINISHES are specified for many machined jet engine components. Generating these smooth finishes at reasonable manufacturing cost is often something of a problem. In the case of one large-diameter component, a finish of 32 micro-inches, rms, was required. Under ideal laboratory conditions, operating at low feeds, this finish can be produced by turning. Under production conditions, however, operating at normal feeds, the best finishes obtainable are from 50 to 70 micro-inches. To obtain smoother finishes, it is necessary to operate at lower feeds, resulting in prohibitively long machining time.

Accordingly, it was decided to turn the parts to

a 50-70 microinch finish and to generate the required 32 microinch finish in a second operation. Proposed finishing methods included grinding, hand polishing and barrel finishing. Although it was known that the 32-microinch finish could be produced by grinding, grinding methods were excluded from consideration because of the belief that grinding induces residual stresses which have an adverse effect on fatigue endurance limits. Hand polishing was tried out, but proved slow and costly and it was impossible to obtain uniform finishes with hand operations.

Preliminary experiments showed that barrel finishing produced satisfactory finishes at acceptable rates of speed. There were, however, several unknown factors connected with the barrel finishing process. Specific information on the effect of barrel finishing on fatigue endurance limits and on surface conditions was lacking. A series of tests was run to find the answers. For comparative purposes, the effects of several other surface-finishing methods were tested at the same time. The tests showed that barrel finishing was the most satisfactory method for the parts in question.

**Testing Procedures:** Strips of AISI 4130 steel, 0.082 inch thick, hardened to  $35 R_C$ , served as test specimens. These strips were machined to the usual sheet fatigue specimen configuration, Fig. 1. All specimens were initially machined on a shaper to a finish of 60-80 microinches to duplicate the type of finish obtained in production turning. Sufficient stock was left to permit final processing to the desired thickness. The finishing processes tested were conventional grinding, barrel finishing, hand polishing, electrolytic grinding and electrodischarge machining. Eight test specimens were produced by each method. A set of specimens finished on the shaper served as controls.

Two groups of ground specimens were prepared.

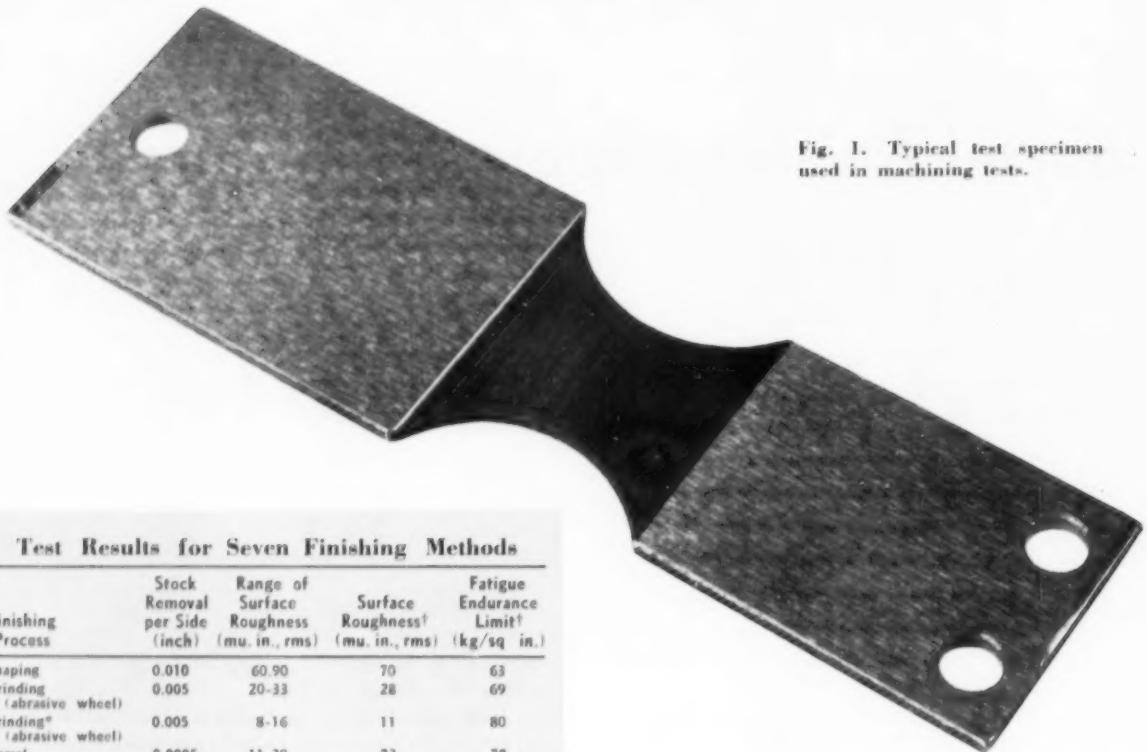


Fig. 1. Typical test specimen used in machining tests.

### Test Results for Seven Finishing Methods

Finishing Process	Stock Removal per Side (inch)	Range of Surface Roughness (μ in., rms)	Surface Roughness <sup>†</sup> (μ in., rms)	Fatigue Endurance Limit <sup>‡</sup> (kg/sq in.)
Shaping	0.010	60-90	70	63
Grinding (abrasive wheel)	0.005	20-33	28	69
Grinding* (abrasive wheel)	0.005	8-16	11	80
Barrel	0.0005	11-30	23	78
Hand Polishing	0.001	11-30	20	70
Grinding (electrolytic)	0.005	20-35	26	74
Electrodischarge Machining	0.005	—	54	67

<sup>†</sup>Average.

<sup>‡</sup>Wheel dressed fine.

Operating conditions were the same for both groups except that the abrasive wheel was dressed finer for one group than the other in order to obtain a smoother finish. All operating conditions were closely controlled to avoid inducing residual stresses in the workpiece material. Downfeed was 0.0002 inch.

The barrel-finished specimens were processed in a closed octagonal barrel, using fused aluminum-oxide chips as the tumbling media. A non-foaming compound was added to prevent rust and the water level was kept low to accelerate the cutting action. Hand-polished specimens were prepared by using a 150-grit cloth for roughing and 220-grit cloth for finishing.

Electrolytically ground specimens were machined by removing 0.005 inch of stock in one pass at a feed of 3 inches per minute. In processing specimens by the electrodischarge process, each side was machined in three passes, using a brass electrode wheel rotating at 400 rpm.

**Test Results:** After machining, the surface roughness of all specimens was measured by the same method. Fatigue strength was measured in a special General Electric electromagnetic blade fa-

tigue testing apparatus. Comparative roughness and fatigue endurance limits are shown in the accompanying table.

When test results were plotted, Fig. 2, it was evident that the fatigue endurance limits of specimens produced by various methods fall relatively well within a scatter band which is inversely proportional to their surface roughness. Specimens with the lowest measured surface roughness have the highest fatigue endurance limits.

It will be noted that all processes resulted in improved fatigue limits as compared to the control specimens finished on a shaper. Hand-polished specimens showed the greatest surface finish and fatigue strength variations from specimen to specimen; ground specimens the least. The latter result could be predicted because of the close controls which can be maintained in grinding and the uniformity of the cutting edges applied to the workpiece.

The general opinion that grinding operations induce stresses which are detrimental to long fatigue life was disproved by the tests. Such stresses are the result of thermal damage to the surface which can be avoided by care in grinding.

Individual barrel-finished specimens showed the highest fatigue endurance limits of any of the specimens tested. It might be expected that differences in fatigue strength between ground and barrel-finished parts could be accounted for by differences in residual stresses. Subsequent work has shown, however, that residual stresses of much greater magnitude than those developed in the test specimens

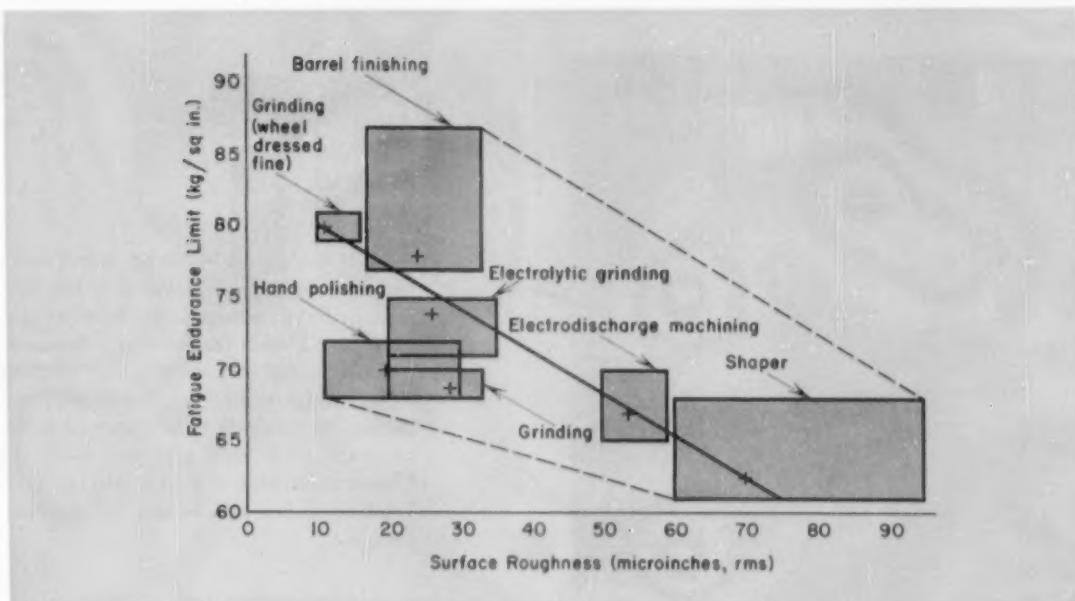


Fig. 2. Results of surface finishing tests. Boxes show the range of measured surface roughness and fatigue endurance limits for each group of test specimens.

Crosses indicate points where the average roughness and average fatigue limit lines for each group intersect. Smoothest parts have highest fatigue strength.

produce no significant change in fatigue strength of similar alloys of the same hardness.

Smoothener finishes were obtained by electrolytic grinding than with the electrodischarge process. Thus the fatigue strength of the electrolytically ground specimens was higher. Previous investigations had shown that rapid electrodischarge machining produces a definite molten surface condition during machining and therefore alters the surface; however, this condition was not present in the test specimens, principally as the result of the slow processing.

**Conclusions:** Barrel finishing was ultimately selected as the preferred method for finishing the jet engine parts under consideration. It produces the desired surface finish at relatively low cost. An additional advantage of the process is that bolt

holes are deburred and radii generated on certain critical edges during the finishing operation, eliminating the need for subsequent operations.

Results of the tests established conclusively that the degree of surface roughness has a pronounced effect on the fatigue limits of hardened AISI 4130 steel. There appears to be no significant difference between the fatigue limits of specimens of the same roughness finished by different methods. A barrel-finished specimen will have the same limits as a comparable ground specimen.

The most desirable finishing method for jet engine components or for any other part is one which produces the specified surface at the lowest cost. Experimental work of the kind described makes it possible to select a finishing process on the basis of results, rather than guesswork or personal preference for any one process.

## Work Prospects Spur Search for Hardier Alloys

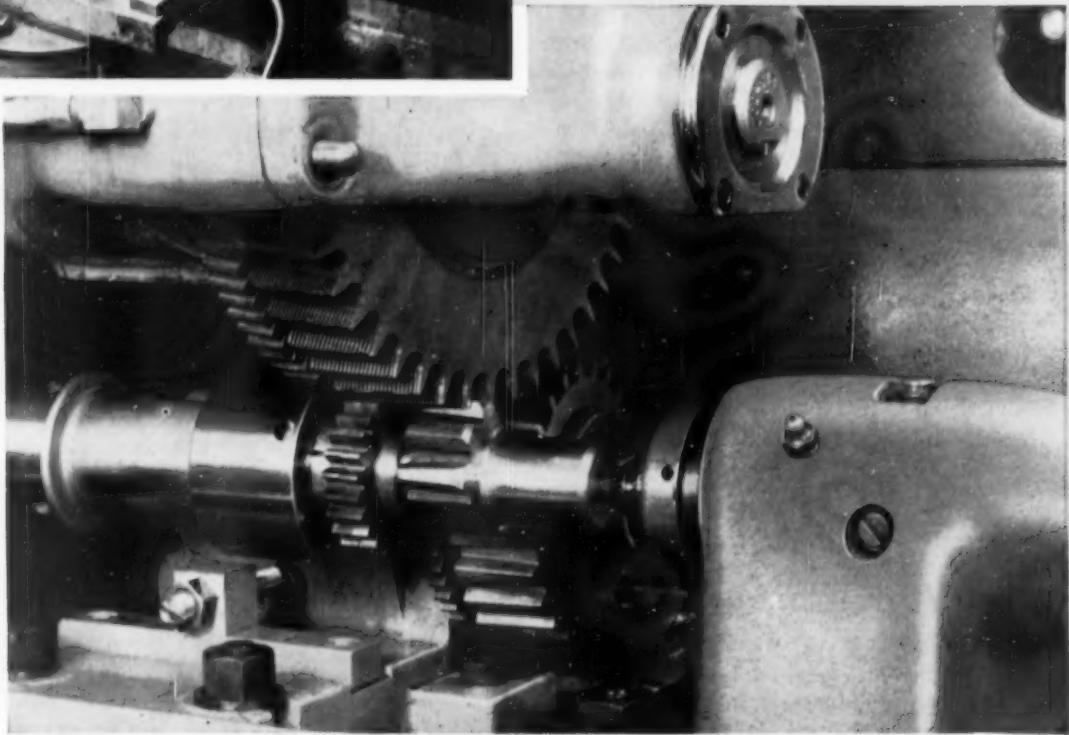
ADVANCES into the era of automated manufacturing is resulting in compounded burden on metal because of its role both in machines and in tools necessary to keep them running. Kempton Dunn, president of American Brake Shoe Co., points out that because of the shorter work week for man and the longer work week for machines, metals used to

make the machines are being subjected to unprecedented punishment. Facing such facts, Mr. Dunn emphasizes that industry must discover and use alloys capable of taking on this new load.

Custom tailoring will possibly be the answer, according to Mr. Dunn whose company currently is spending \$500,000 a year on metallurgical research.



Carbide tooling and air-gage tracer unit team to produce a precision body for aircraft hydraulic accumulator. Contour accuracy and wall thickness are held to within  $\pm 0.002$  inch while a high quality surface finish is attained in volume production on Monarch lathe equipped with automatic cycle unit and air chuck at Cleveland Division of Parker Aircraft Co. Total machining time is only 2.2 minutes per piece.

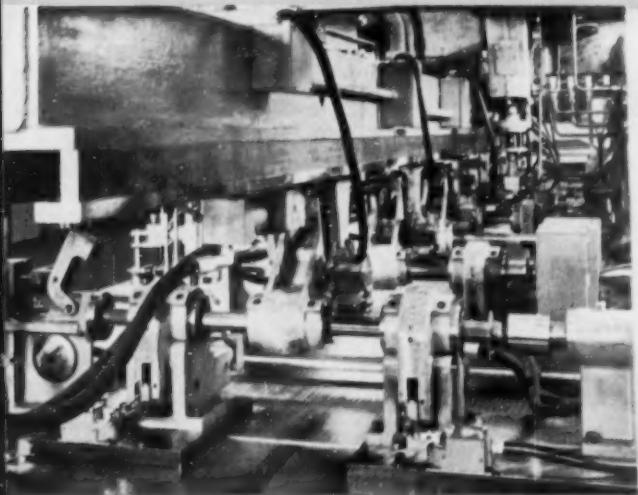
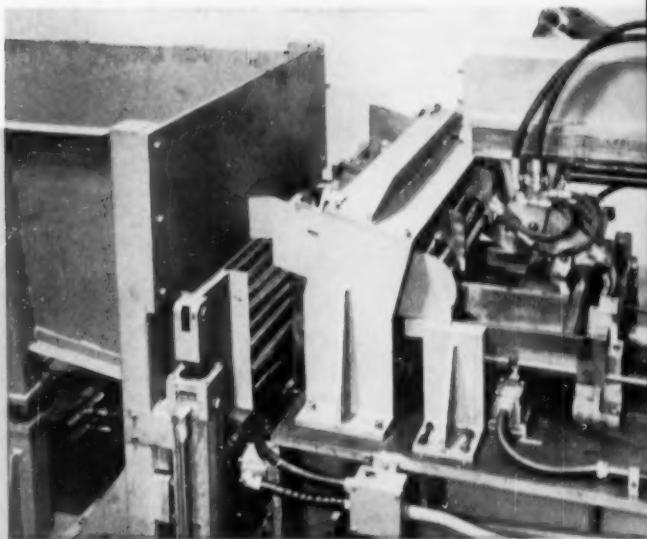


—Photo courtesy National Broach & Machine Co.

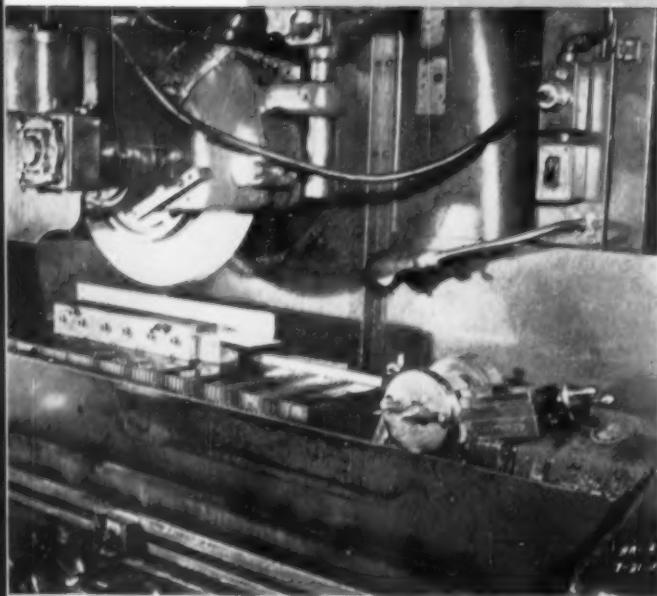
Combination shaving and deburring operation finish machines sector gear. The tool has conical involute tooth shape and meshes with the gear segment. Form of the deburring tool teeth is designed to mate with the workpiece and remove shaving burr as it is produced.

# TOOLS at work

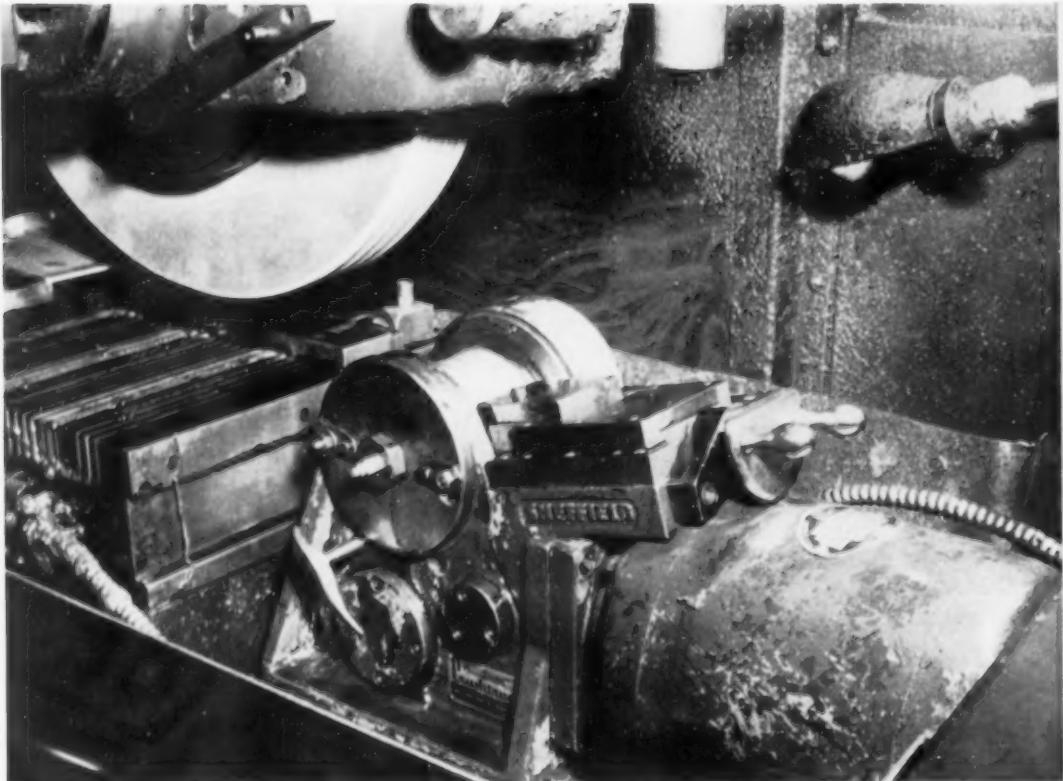
Automatic transfer integrates welding, machining, assembly and testing of tubular component. Loading mechanism (top) has inclined hopper, lifter plate feed magazine and reciprocating shuttle plate and is air powered. Seven clamping fingers on the transfer bar are hydraulically operated, and move the part between stations (below). In succeeding stations the flange is pressed to the tube, spot-welded, four slots pierced in the tube while spot welding is done on flange. Then drilling, spot welding, reaming and testing are performed in sequence. Production rate is four hundred units per hour in the Expert machine. Adjustments permit handling the two different assemblies shown.

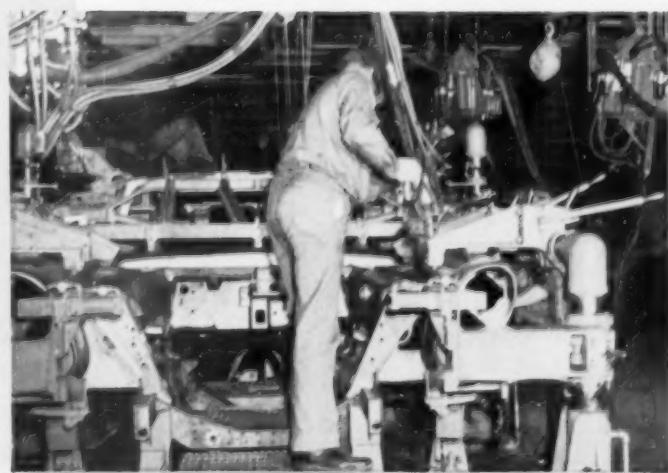
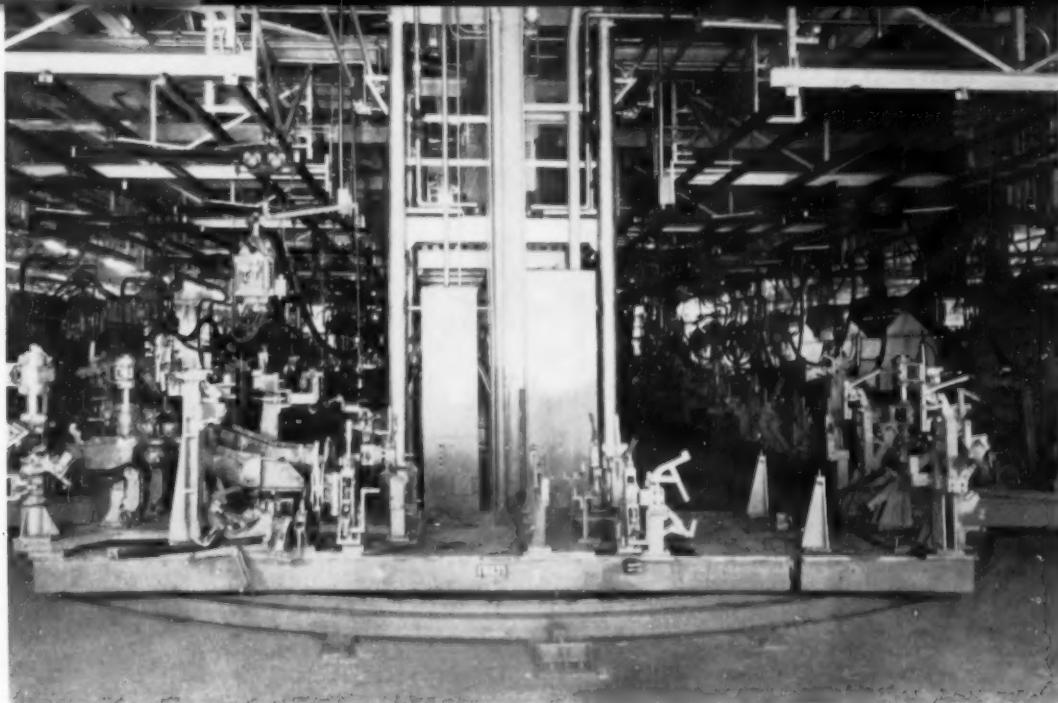


## TOOLS at work

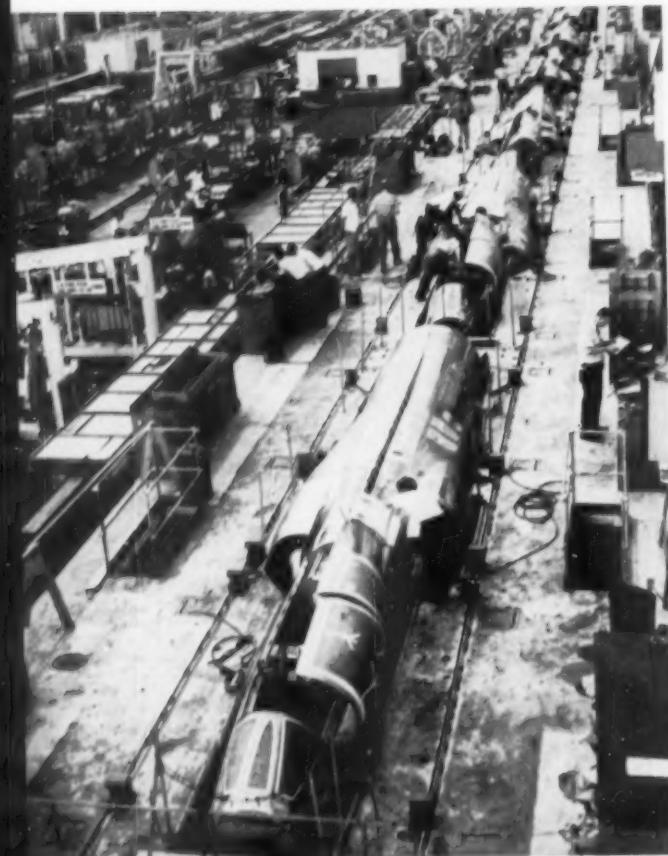


Form grinding of button facing tools is accomplished in unusual setup at Standard Button Machine Co., Paterson, N. J. The tools are of M-2 HSS, hardened to 63 Rockwell C. The work-holding jig makes possible finishing 36 tools at a time. Table speed of the Mattison surface grinder is 35 fpm and downfeed is 0.001 inch. A Sheffield Crushtrue device is mounted on the machine table. The wheel is dressed (bottom) with every finish cut, and the crush-form die is recut twice daily. A speed reducer on the wheel spindle slows it to 36 rpm while in contact with the crush-form wheel.



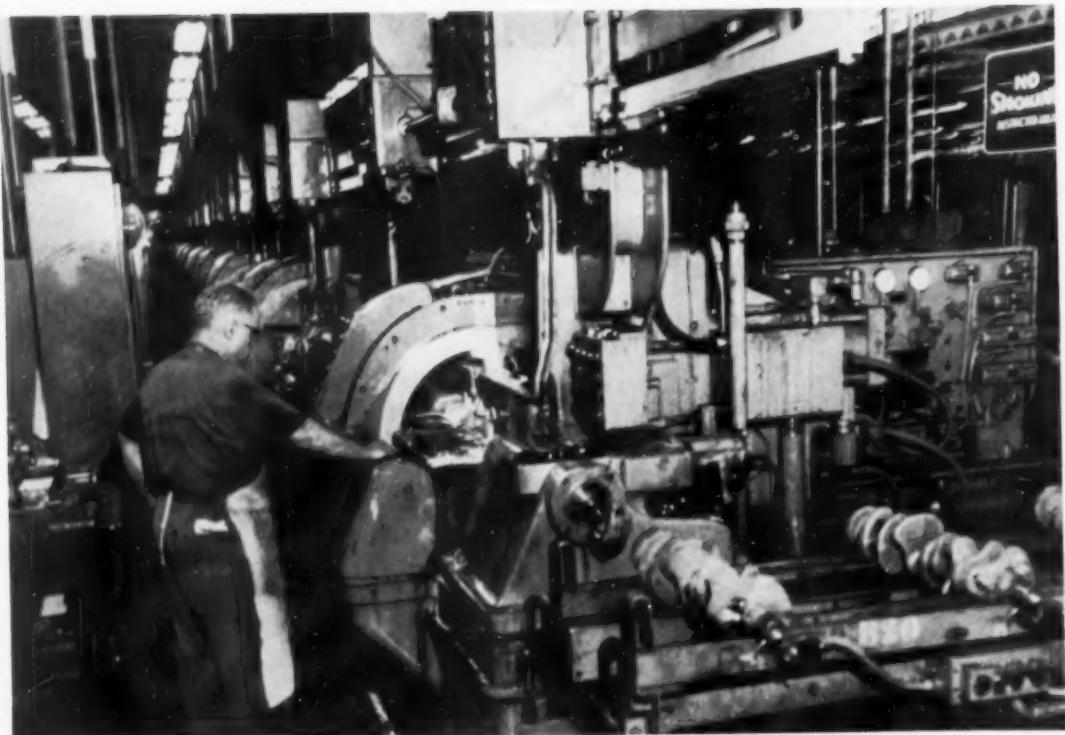


Merry-go-round is multistation welding fixture for assembly of unitized underbody at Lincoln plant of Ford Motor Co. Underbody is built up in stages with parts assembled by 1250 spotwelds (close-up) as it moves around the line. Scheduled rate of 30 units per hour can be reached in full production. Unitized body is then assembled in one-stage buck, where 568 spotwelds are applied. The operation is accomplished in about 12 minutes with a six-man crew.



One of the keys to American productivity has long been the production line. The techniques of continuous-flow production have been applied to products as dissimilar as crankshafts and airplanes. Fuselage sections for the ultra-sonic F-104 Starfighter (left) are shown on an assembly line in one of Lockheed's division factories in Burbank, Calif. Completed fuselages are trucked to the Palmdale plant for final assembly and flight testing. "Detroit Automation" is exemplified by the battery of Wickes automatic center drive lathes at Chrysler's Mound Road engine plant (below). Crankshafts are automatically conveyed between machines. One worker handles three machines. Machining time is about two minutes per crankshaft.

## TOOLS at work



# cutting material and machining costs

## *...with power roll forming*

By E. W. Bartle\*

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**Rising costs and the introduction of new, hard-to-machine alloys in the aircraft industry have created high interest in processes for shaping parts without machining. One of the most promising of these is power roll forming. The author describes the process and discusses the results of recent development tests on a variety of parts.**

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**P**OWER ROLL FORMING is a cold rolling process in which material in a blank is caused to flow over a rotating mandrel. Forming is accomplished by one or more hardened steel rollers. *Fig. 1*, which travel parallel to, and at a pre-set distance from, the surface of the mandrel during forming. As the mandrel and workpiece are revolved, the rollers, which may be either hydraulically or mechanically actuated, displace the blank material in a spiral manner. Contours of the formed workpiece are identical with those of the mandrel and wall thickness can be closely controlled.

This control over workpiece contours and wall thickness gives the process significant advantages

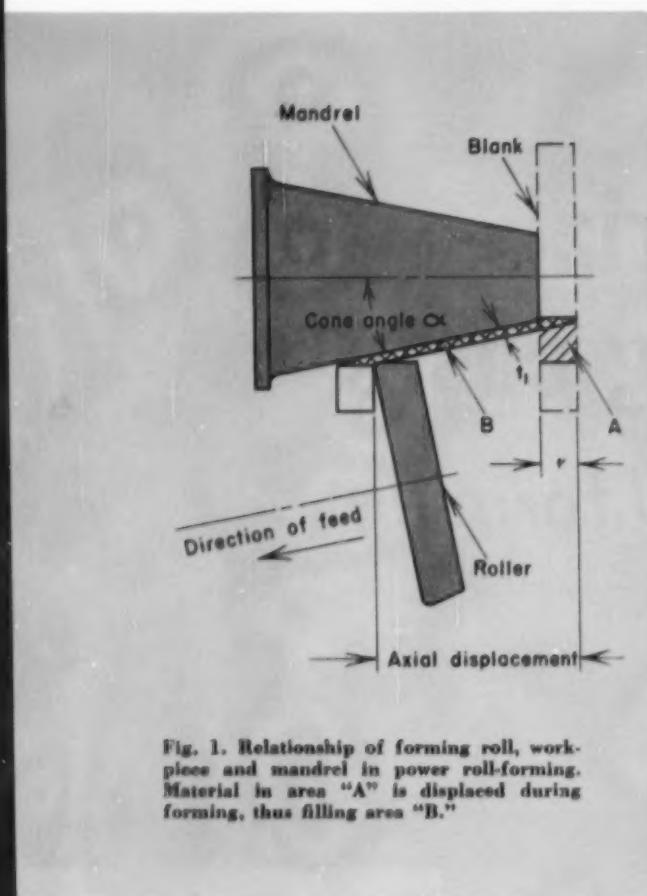


Fig. 1. Relationship of forming roll, workpiece and mandrel in power roll-forming. Material in area "A" is displaced during forming, thus filling area "B."

over spinning and drawing. In spinning, springback is often a problem and even highly skilled operators find it difficult to maintain uniform wall thicknesses. Springback is likewise a problem in drawing operations.

Roll-forming differs from both spinning and drawing in that the workpiece material is drawn from the thickness, rather than the diameter, of the blank. The diameter of the finished part is the same as the diameter of the blank. Further, a volume of material that is a given distance from the axis of the blank will be at the same distance from the axis of the finished part.

**Blanks:** Cone-shaped parts are usually produced from flat blanks. Preformed blanks are required for the production of cylindrical parts, or parts having cylindrical sections. The purpose of pre-forming is to provide sufficient volume of metal to maintain desired wall thickness. Preformed blanks may be divided into four types:

- Drawn, machined, spun or welded cups
- Machined forgings
- Machined centrifugal castings
- Welded cylindrical or conical sections.

With welded blanks, it is important that the weld be ground flush with the parent metal and that the entire structure be annealed prior to roll forming.

When forming a cone-shaped part from flat stock,

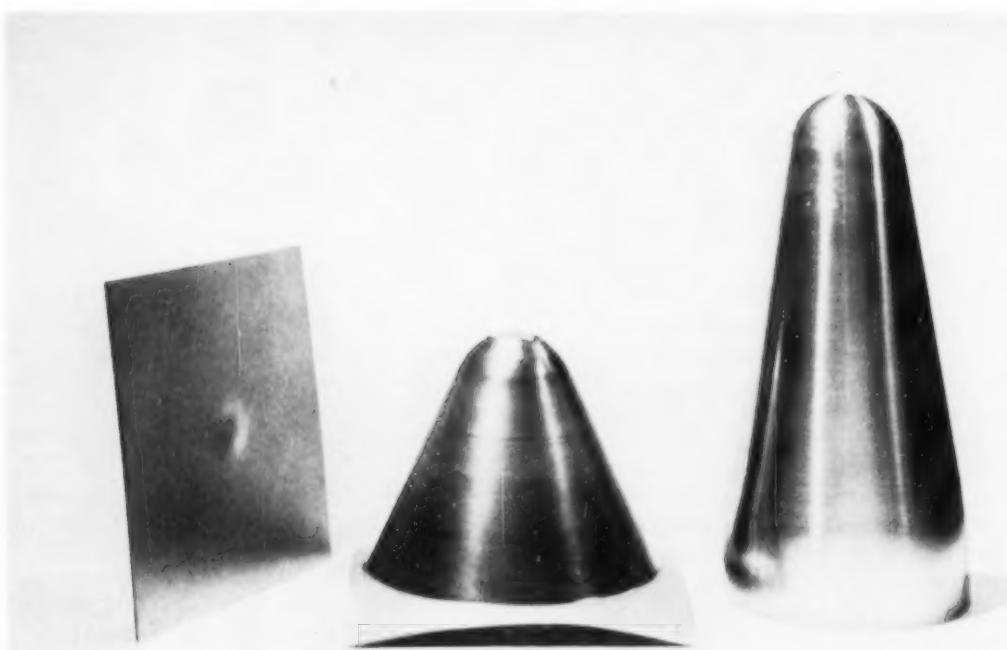


Fig. 2. Steps in forming a part from a flat plate.

the final thickness of the wall,  $t_1$ , is equivalent to the thickness of the blank,  $t$ , multiplied by the sine of the cone angle,  $\alpha$ . Thus, when final wall thickness and the cone angle are known, blank thickness can be determined by dividing the final wall thickness by the sine of the cone angle. A typical conical part is shown in *Fig. 2*.

For cylindrical parts, which have sides parallel to their axes, wall thickness of preforms, *Fig. 3*, is governed by the length of the preform and the required length and wall thickness of the finished part. There must be sufficient metal in the preform to permit rolling the part to specified length and wall thickness.

For satisfactory results in forming, blank thickness must be held to close tolerances. If, for example, a blank is too thick, excess material will accumulate at the entry side of the roller. Consequently, as the operation progresses tensile hoop stresses will be set up in the blank, causing it to deflect into a shallow cone or causing the finished part to lift from the mandrel. If, on the other hand, the blank is too thin, material will be used up at a faster rate than intended. The resultant stretching offsets the benefits of cold working and, in extreme cases, causes material failure.

In the case of cylindrical parts, variations in wall thickness of the preform will be reflected in variations in the length of the finished part. Thus, thickness of blank material is critical and should be closely checked. Heavy, flat blanks should be sur-

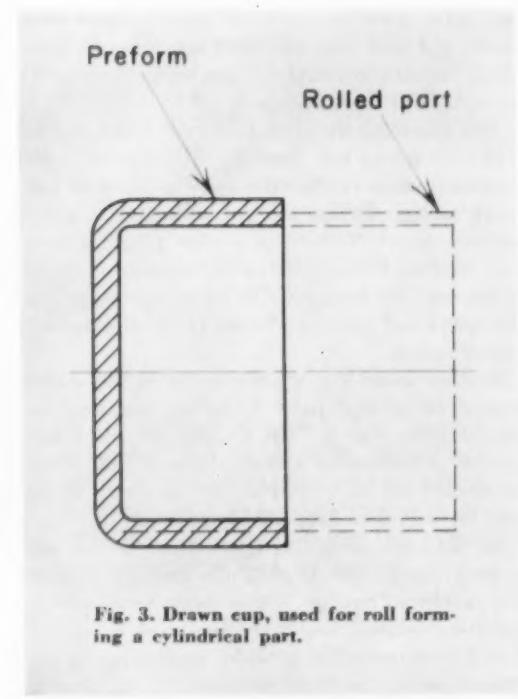
face ground to the required tolerances and forged or cast preforms, *Fig. 4*, should likewise be machined to close tolerances.

**Workpiece Material:** A wide variety of metals have been successfully roll-formed. Series 300 and 400 stainless steels, for instance, are readily worked and form excellent parts. Low-carbon steels, such as SAE 1010, 1020, 1030, 4130 and 4132, are easily formed. Steels such as AMS 5538 and 5539, have also been formed with good results, as have Incomel and Monel. Molybdenum and various titanium alloys have been formed successfully with the application of heat.

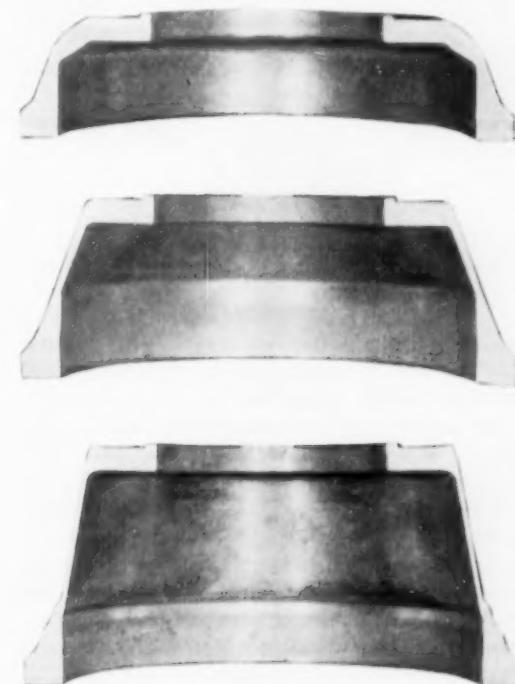
It is possible to work all aluminum alloys when they are in the annealed, recrystallized condition. If heat-treatment is required, it must be done after forming.

For successful roll forming, the workpiece material must be free of defects. The process does not weld the material, so laminations and other flaws tend to open up during rolling. Normally, the part will break immediately. If, however, a lamination is close to the surface, it will appear in the form of a blister or "orange peel" on the finished part.

**Physical Properties:** The cold working which occurs during forming definitely changes the physical properties of the material. Physical properties of Type 302 stainless steel, before and after rolling, are shown in *TABLE 1*. The finished part was a cone



*Fig. 3. Drawn cup, used for roll forming a cylindrical part.*



*Fig. 4. Steps in forming a part from a cup type preform.*

**Table 2—Cross Sections of Roll-Formed Samples**

Cone Material	Base Thickness (inch)	Wall Thickness (inch)	Wall Thickness Variation (inch)	Reduction in Thickness (percent)
AMS 5538	0.125	0.0485	0.0005	63.5
AMS 5539	0.078	0.0295	0.0005	63.3

**Table 1—Change in Physical Properties of Roll-Formed Stainless Steel**

	Tensile Strength (psi $\times 10^3$ )	Elongation (percent)	Hardness
Blank	85-90	50	80-90 RC
Finished Cone	175-180	5-6	30-35 RC

**Fig. 3. Flanged part produced in one piece by power roll forming. This part was produced from a preform.**

having a 30-degree included angle. It can be seen that the ultimate tensile yield strength was greatly increased and the elongation was decreased.

During the course of recent experimental work, samples of roll-formed AMS 5538 and AMS 5539 were submitted for metallurgical examination. Base and wall thicknesses are shown in TABLE 2. Compositions of these two materials are identical; however, AMS 5539 is stress relieved. Physical tests show that a reduction in thickness of 63 percent by roll-forming results in a 53 percent increase in ultimate tensile strength for AMS 5539 and a 58 percent increase for AMS 5538.

The rolling operation leaves the samples in a highly stressed condition. Heating to 1200 F and

air-cooling relieves the internal stresses, but reduces the ultimate tensile strength of the AMS 5539 by 10 percent and the tensile strength of AMS 5538 by 5 percent. Annealing at 1800 F after forming reduces the tensile strength of AMS 5539 by 39 percent. The sample tested did not meet tensile strength specifications. Tensile strength of the AMS 5538 sample was reduced by 32 percent.

The tests indicated the importance of careful control over the heat-treatment of roll-formed parts. Heat-treatment procedures will vary for each material.

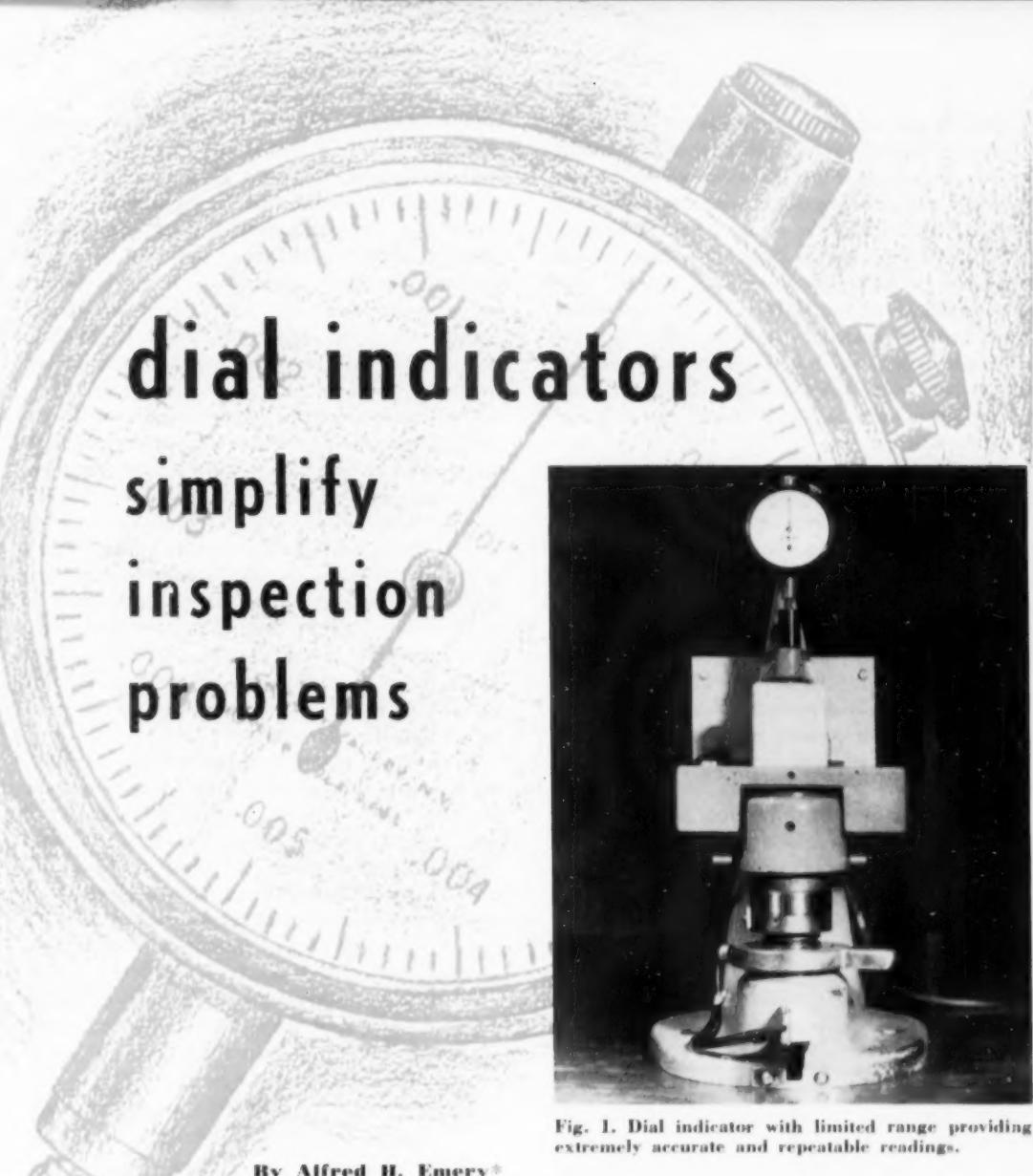
Bend test requirements for AMS 5539 specify that the material should bend through an angle of 90 degrees around a radius equivalent to the thickness of the material, without cracking. The annealed samples met this requirement. Corrosion resistance, as measured by the Strauss Test, was not affected by roll forming, by subsequent stress-relieving or by annealing operations.

**Applications:** At present, power roll forming has found a number of applications in jet engine and guided missile manufacture. It is also being used for the manufacture of utensils, notably milk pails. The pails are produced from stainless steel blanks and have thin walls and heavy bases. Neck tubing for stainless steel thermos bottles is also roll formed. Wall thicknesses are held to 0.007 inch.

This illustrates the close tolerances which can be held with power roll forming. The process holds especial promise for manufacturers of thin-wall precision tubing. Tubing for hydraulic cylinders, for instance, can be formed in a wide range of sizes with internal finishes equivalent to those produced by honing. Machining and finishing operations are eliminated and parts are, for all practical purposes, distortion-free.

Another interesting application is in the manufacture of tubular parts requiring thickened or flanged ends, *Fig. 5*. The flanges may be either internal or external or a combination of both. Since the flanges can be formed as part of the tube, the need for welded-on flanges is eliminated.

On the basis of existing applications, power roll forming has proved its ability to simplify production problems. Savings in machining time—and in material, welding, and inspection cost as well—should lead inevitably to wider application of the process during the next few years.



# dial indicators simplify inspection problems

By Alfred H. Emery\*

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With current demands for greater precision in manufacture, inspection methods and equipment take on added importance. This article suggests some practical ways for getting the maximum use from dial indicators.

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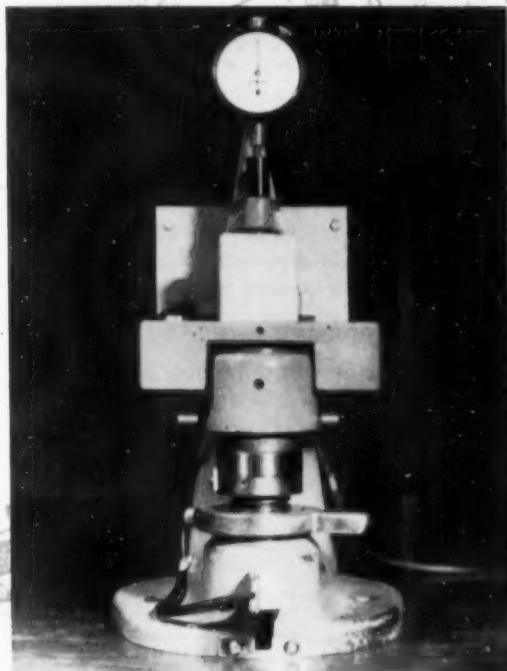


Fig. 1. Dial indicator with limited range providing extremely accurate and repeatable readings.

**I**N PRESENT-DAY competitive production, industry is required to manufacture parts with closer and closer tolerances. With fluctuations due to temperature variations an important factor, it is doubtful that tolerances can be reduced by any appreciable amount.

Although most manufacturing is controlled by tolerances in increments of 0.0001 inch or greater, there are some instances where tolerances are specified in increments of 0.00005 inch.

To keep pace with this trend toward greater precision manufacture, noteworthy advances have been made in inspection methods. For instance, dial indicators have been improved to the point where they can be relied upon to measure to an accuracy of

0.000025 inch or better in inspection operations.

This advance in accuracies obtainable in inspection measurements, *Fig. 1*, is best illustrated by comparison with existing standards. American Gage Design Standards for the accuracy and repeatability of dial indicators were adopted more than a decade ago. For many applications, these accuracy specifications now appear to be too broad for present day use. The standard specifies that: "The dial indicator shall be accurate to within one graduation, plus or minus, at any point from the approximate ten o'clock position to the final two o'clock position" (2½ turn).

This means that an indicator with 0.0001-inch graduations could have an error of plus or minus 0.0001 inch in a movement of, for example, five graduations (0.0005 inch) from the zero setting. Such an error of 0.0002 in 0.0005 inch would equal 40 percent. In contrast, most dial indicators available now have much closer accuracy. For example, indicators with graduations in 0.0001 inch are now available with accuracies of 0.000025 inch or better. In an indicator of this type a pointer movement of five graduations from zero, equalling 0.0005 inch, may have a variation of only 0.000025 inch. Because this error is insignificant, the operator can take advantage of his full working tolerance without the necessity of sacrificing part of the tolerance to linear error in the indicator. Another noteworthy

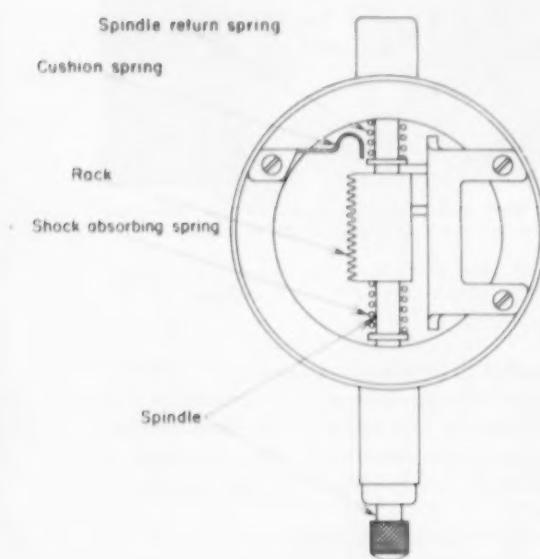
improvement is the ability to produce repeated readings. Indicators are usually limited to a range of less than one revolution.

The AGD specifications for repeatability state: "Readings at any point shall be reproducible through successive movements of the spindle to plus or minus one-fifth graduation." This specification appears to be quite satisfactory for present-day requirements, since on a 0.0001-inch dial indicator the specified one-fifth graduation represents 0.00002 inch.

To obtain accuracies such as these, the internal mechanisms of dial indicators must be built with greater precision and must contain components proportioned and constructed to suit these requirements. Jeweled bearings, gear-pivot bearings designed for reduced friction, more accurately generated gear teeth and other features contribute to this end. These precision components could not stand the strain of normal use without some means of shockproof protection, however, the two go hand in hand, a fine, precisely built internal mechanism and isolation of that mechanism from sudden impact on the operating spindle.

In the past it was often thought that dial indicator accuracy was affected by the use of shockproof construction. This is untrue. Properly constructed shockproofing is necessary to permit the use of the precision internal components. Shockproof construction actually contributes to the accuracies obtained. One method of shockproof construction is shown in *Fig. 2*. Similarly, some inspection groups have avoided jeweled movements because of possible jewel breakage—even though jeweled indicators provide greater accuracy and sensitivity, and longer life. In shockproof indicators it is virtually impossible to break or damage the jewels.

Another misconception is that a shockproof model should be used only when there is danger of damage



**Fig. 2. (above)** Diagram of case assembly for shockproof dial indicators. The cushion spring prevents internal damage when the spindle reaches the end of its travel, and the rack operates the internal gearing.

**Fig. 3. (right)** Precision checker for testing accuracy of dial indicators.



from sharp impacts or vibration. However, even a common indicator application applies tremendous force to the gear teeth and other components. In a conventional 2 1/4-inch indicator with 0.0001-inch graduations, the end of the pointer travels 625 times as far and as fast as the corresponding spindle movement. Lifting of the contact point by the part in successive checking operations may seem gentle, yet it is actually quite severe because of this tremendous amplification factor. In shockproof indicators, the internal mechanism is activated by a tension spring and, no matter how fast parts are applied beneath the contact point, the force operating the mechanism remains constant and gentle. The impact of a rifle bullet would not increase the gear operating force.

With many thousands of dial indicators in use throughout industry, it is surprising that many concerns, both large and small, have no means of checking their indicators. In most of these plants extensive methods are employed to constantly check other types of gages such as plug, ring and snap gages, gage blocks, etc. Obviously some means must be employed to check indicators which are expected to deliver precise measurements on a long-term basis. As precision instruments they should not be taken for granted.

A device for rapid, accurate checking of dial indicators is shown in *Fig. 3*. It checks all AGD dial indicators to an accuracy of 0.00002 inch. Indicators with special ranges up to 1.000 inch can also be

checked. In the absence of such a checking method, indicators can be checked by a simple comparator stand and gage blocks set up to check various points throughout the range. Although this method takes more time, the results are positive.

Since the AGD specification for repeatability does not specify how the test shall be made and, since the method of checking will have a definite bearing on the results, it is obvious that the method should approximate as closely as possible actual operating conditions. A suggested method is to use a comparator stand and a single gage block—applying the gage block under the contact point and setting the indicator to zero. When the gage block is applied beneath the contact point slowly and then rapidly, the deviation in the readings should not exceed one-fifth graduation on either side of zero. This method closely duplicates actual measuring conditions. If the test is made by only the slow or fast gage block application, the indicator should show a nearly perfect duplication of readings each time.

Advances in dial indicator design have closely paralleled advances in modern industry. Indicators provide an economical means for close measuring. Initial cost and upkeep are low. They have exceptionally long life and produce instantaneous readings. They are self-contained and require no external connections or power source. Their compactness permits multiple mounting in close proximity on multidimension measuring fixtures.

## Cold Reducing Yields Steel Savings

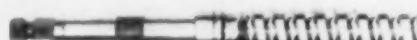
BY COLD REDUCING hot-rolled steel bars, as much as one ton out of every three can be saved during mass production of multidiameter machine shafts. The Republic Die-Form process, as it is called, produces carbon, alloy or stainless-steel blanks which closely outline the shape and size of a finished part. A finishing cut and/or grind completes the operation.

Principle of the process involves pushing dies over the die-form blank from opposite ends to the required distance and striping them off again. For further reduction, the operation is repeated on either or both ends of the blank. Pushing in this manner defeats an attendant danger in attempting large reductions by cold drawing—that the load required to pull the bar through the die may exceed the bar's tensile strength and cause it to break.

The method, developed by the Bolt & Chain Div. of Republic Steel, was originally applied to automotive transmission shaft blanks with an eye to conserving steel. As a result, 200 tons of hot-rolled bars were made to produce the equivalent of 300

tons of cold-drawn bar stock.

Engineers involved with the process maintain that in some cases physical properties of the steel, as well as machinability of the bar, can be improved during the process. Although not economical on short runs, the technique holds diameters to within 0.005 in. Lengths of shoulders or step downs are held to within 0.0625 in., while straightness can, in some cases, be held to 0.005.



Specially developed blank for Chrysler Corp. is shown with resultant hot-rolled steering worm shaft.

# How Flat is FLAT?

By John Stonitsch

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**I**N INDUSTRY, standards of flatness vary. A degree of flatness which is adequate for one product may be inadequate for another. The development of new products calling for higher degrees of flatness has made it necessary to develop new inspection methods.

Measuring the flatness of the faces of platens for aerial cameras was something of a problem to engineers at Fairchild Aircraft and Instrument Corp. Flatness of these platens is critical. Aerial photographs are used by road builders to obtain exact measurements of land contours and by lumbermen to obtain estimates of the number of board feet of wood in a stand of timber. Accuracy of such

measurements is dependent, to a large degree, on the flatness of the film in the camera at the time the photograph is taken. To insure flatness, the film is held against the platen by vacuum pressure. Flatness of the platen is held within  $\pm 0.0005$  inch.

Conventional dial indicators did not give fully satisfactory results in measuring platen flatness. The possibility of designing a special checking fixture was considered; however, preliminary estimates showed that the cost would have been excessive.

The problem has been solved with an air gage. A granite surface plate, accurate within 0.000050 inch, is used as a reference plane. The platen is mounted on four standard gage blocks which hold it at a known distance from the reference surface. A flat air probe, which has 0.000050 inch clearance when positioned between the reference surface and the platen, acts as a gaging head.

The probe is connected to a column type air gage. As the probe is moved to different locations between the platen and the surface plate, variations in flatness can be read directly from the air gage. The readings are accurate within 0.000050 inch. Cost of the gage is less than one-fifth that of a special checking fixture and the checking operation is simple.

This checking method has also been applied to measuring the flatness of photosensitized glass plates used in calibrating high-precision aerial camera lenses. Here again, it provides a fast answer to the question: "How flat is flat?"

Air probe checks flatness of a camera platen. Operator records readings, obtaining a profile of the surface.



# good ILLUMINATION improves plant efficiency

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**D**ISCOVERY OF THE FACTS that lighting and color have important effects on workers' productivity has initiated a trend in industry. Bright colors, and fluorescent and other types of improved illumination are being adopted. Scientific methods and an engineering approach to plant lighting are giving positive results in higher production and better employee safety.

Standards for acceptable illumination levels have been established by the Illuminating Engineering Society. These standards measure lighting throughout the total area on a horizontal plane 30 inches above the floor.

Light is best measured by a foot-candle meter or

illuminometer. One foot-candle is the amount of light falling on a surface from a standard candle at one foot distance. Determining the exact amount of light required for industrial work requires a trained technician using scientific instruments. Here are the standards set for machine work:

Rough bench and machine work.....	20 foot-candles
Medium bench and machine work, automatic machines, rough grinding,	"
medium buffing and polishing.....	30 "
Fine bench and machine work, fine automatic machines, medium grinding, fine buffing and polishing.....	50 to 100 "
Extra fine bench and machine work grinding, fine work.....	above 100 "

The latter two figures mean that a combination of general illumination and supplementary lighting at the point of work is needed. Light acts as a magnifier of small details. An object must be about twice as large to be visible under one foot-candle of light as under 100 foot-candles. The latter is approximately one percent of maximum daylight.

A good installation should provide sufficient light, proper direction of light diffusion and eye protection. It should also eliminate direct and reflected glare as well as objectionable shadows.

An important consideration for illumination is that where safety goggles are worn the light reaching the eye is likely to be materially reduced. The

general level of lighting should be increased accordingly in workrooms where goggles are required.

Fluorescent lighting has a high over-all efficiency and provides an improved quality of light closely approaching daylight. Its efficiency is more than twice that of incandescent lighting. Less glare and shadow effect with better uniformity are secured by its broad area and low brightness of lamps. Fluorescent lighting is less sensitive to voltage fluctuations, which cause flickering, resulting in eye-strain. Lower temperatures give a greater degree of comfort where work close to the light source itself is needed.

Lighting of welding shops is often haphazard, the assumption being that enough light is produced by the workers themselves. Goggles or screens protect the eyes from injury due to splashing metal, or to infrared, visible and ultraviolet radiation.

The brightness of the welding arc or flame is greatly reduced by goggles which also cut down illumination of the work. Often lighting of a welding shop is insufficient to permit inspection to be made without the welder raising his goggles, thus exposing his eyes to flashes produced by neighboring workers.

Illumination of 15 foot-candles should be provided on the horizontal plane, at work level. The brightness of ceiling and walls should be high. This can be achieved by painting them in light colors and planning the installation to distribute a sufficient proportion of the total light output to them.

If these suggestions were followed, lighting engineers believe it would be possible to use goggles which absorb less light and would not have to be removed for inspection of the weld. There would also be sufficient light for other workers to lay out plates and do similar jobs in the same shop.

For rough drawing and sketching 30 foot-candles are necessary. For prolonged close work, art drafting and designing in detail, 50 foot-candles. For fine toolmaking and tool inspection an illumination level above 100 foot-candles is needed.

Still, good illumination alone may not be sufficient. Individual conditions must also be considered. For instance, a tool engineer, 32 years of age, suffered from repeated headaches in the late afternoon, which reduced his working efficiency. He looked everywhere for the cause of the trouble: previous sinus trouble, too little sleep, faulty eating habits, fatigue after long hours of work.

Eventually an eye doctor found that the engineer's eyes were astigmatic. He prescribed the proper glasses and the headaches ceased immediately. Today many more men of advanced years are active in engineering and production due to the increased average length of the duration of life. Many highly skilled older people can continue to perform with

utmost efficiency with proper glasses and if their eyes are assisted by better illumination.

Advantages of scientific illumination may be nullified by poor maintenance. Many lighting installations are cleaned only as lamps fail. Periodic cleaning is important for a fluorescent lamp which collects dust for 2000 hours or for a cold cathode tube which collects dust for 8000 or 10,000 hours in six to eight months' service.

A survey of an industrial fluorescent installation showed that the wrong color of paint, together with collection of dirt on the walls, decreased ultimate light output 11 percent. Accumulated dirt and dust on the lamps and reflectors caused an additional 27 percent loss.

Bright, contrasting finishes on production machinery have been shown to increase safety and efficiency as well as improved employee morale. Modern practice today calls for over-all application of light gray or green finishes. Even more bright colors will be used in the future.

To determine what can be accomplished through use of color, du Pont Company color technicians had sections of a workroom repainted in highly light-reflective shades. The coefficient of light utilization in the workroom had been only 27 percent. When the ceiling was refinished with light cream paint, this change increased the coefficient of light utilization to 35 percent. After that the side walls were refinished with a neutral green. Dark tables and chairs were replaced with blond furniture. The dark maroon floor was recoated with white floor paint stippled with spruce brown.

By this planned use of all reflecting surfaces, the coefficient of light utilization was brought up to 55 percent, an improvement of more than 100 percent over the original arrangement. This was achieved without installing any additional lighting equipment.



"Ceramic tools phooey! Let's try vitamins."



# research REPORT

## Shrink Tests Developed for Tool Plastic

By **Orville D. Lascoe\***

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Now that the first flush of enthusiasm for plastic tooling has passed, tool engineers are becoming more critical of results. The ASTE Research Fund, with the active cooperation of Bakelite Co., Ciba Co., Inc., The Marblette Corp. and Shell Chemical Co., has sponsored development of repeatable tests that will accurately indicate shrinkage characteristics of unfilled epoxy resins and remove one question mark from plastic tool fabrication.

SO THAT USERS CAN anticipate results and producers can formulate plastic tool materials with controlled, or at least predictable, characteristics, quantitative information on resin behavior is necessary. As a first step, it was decided to develop methods for determining shrinkage. To simplify procedures, work was done on one specific unfilled epoxy resin used with one specific hardener under carefully controlled conditions. Two successful tests were developed, one for determining volumetric shrinkage and the other for linear shrinkage. These can aid in fabrication of accurate tools, *Fig. 1*.

Before quantitative experiments could be performed, many preliminary tests were necessary to establish techniques for handling and preparing

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# research report

the materials. Through proper techniques, it was possible to avoid many possible variables.

To ensure thorough mixing of the resin and catalyst, diethylene triamine in a constant ratio of 8 parts to 100 parts of resin by weight, and minimum bubbles, mixing was done by hand. Entrained air bubbles ceased to be a problem when each batch, about 500 g, was centrifuged, *Fig. 2*, before pouring. Materials could be most easily handled when they were allowed to stabilize at room temperatures between 75 and 80 F.

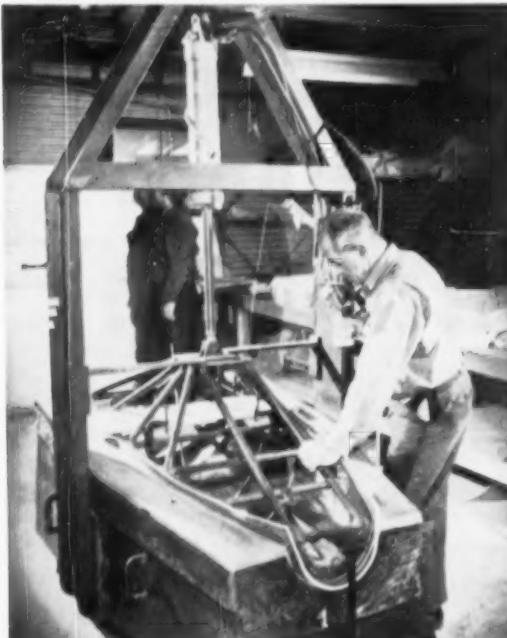


Photo courtesy Rezolin, Inc.

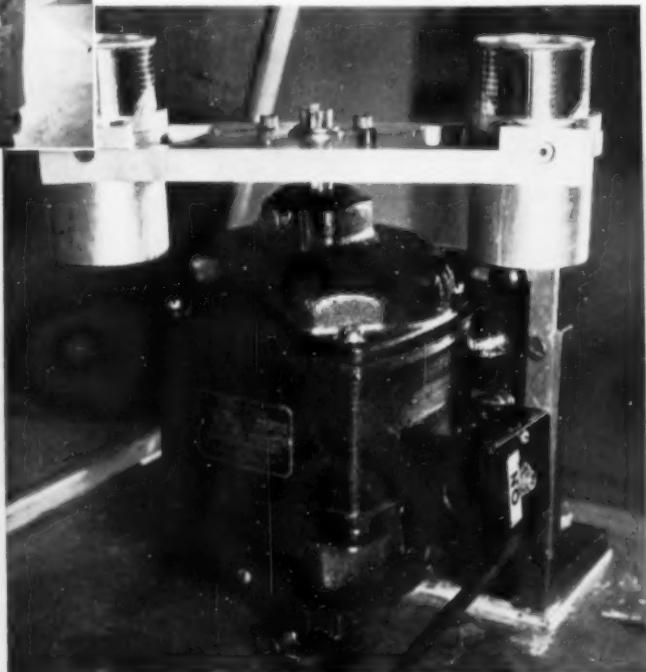
**Fig. 1 (above).** Typical plastic tool used for forming the clear acrylic plastic used to make aircraft canopies. This particular tool produces good optical properties and proper shapes.

So that the materials could be poured into molds without entrapping air, a glass rod or wooden stick was used. With the rod extending into the mold, the resin-catalyst mixture was poured down the rod. Molds were cured in a temperature and humidity-controlled atmosphere.

With satisfactory handling techniques established, it was practical to proceed with development of suitable shrinkage tests. Starting with a number of proposed tests, the research group systematically attempted to prove or disprove their utility. The successful tests are based on information gained from the early, unsuccessful attempts.

**Volumetric Shrinkage:** Apparatus used to determine volumetric shrinkage consists of a test mold, a base plate and a cover plate containing a graduated pipette, *Fig. 3*. After material is mixed and centrifuged, it is poured down a glass rod into two identical molds. When the mold is full, it is closed and a light mineral oil is run into the mold cavity through a filling tube. The oil is allowed to rise in the pipette and then the inlet valve is closed. As the specimen shrinks, oil will run out of the pipette and, by the reduced volume in the pipette, indicate the amount of shrinkage.

Zero time for the test is when the resin and hardener first make contact. The zero pipette read-



**Fig. 2 (right).** Centrifuge developed as part of the research project removes bubbles from mixed batches of resin and hardener. The resin is placed in two disposable metal cans, which require no clean-up, and is whirled at 3450 rpm.

ing is made when the oil inlet valve is closed. After the test is under way, pipette readings are taken every 5 minutes for the first 3 hours and then at  $\frac{1}{2}$ -hour intervals. Each test should be run for a minimum of 5 hours.

After the specimen is removed from the mold, it is accurately weighed. Then the ends are machined parallel and the specimen is again weighed. The volume of the machined specimen is determined from physical measurements and the density is computed. With this information, it is possible to determine all the necessary characteristics of the specimen as it is removed from the mold. The percentage of shrinkage for a given period is determined by dividing the change in volume by the original volume and multiplying by 100. The results can be shown graphically by plotting time against corresponding values of shrinkage, *Fig. 4*.

Curves made during establishment of the test procedure show without exception that the maximum shrinkage rate occurs during the second hour in the mold and begins to level off at the end of the third hour. Immediately after mixing, the shrinkage rate is about 0.0017 percent per minute. After the first hour, the rate increases to a maximum of 0.007 percent per minute. Since it is impossible to determine the actual shrinkage during mixing and pouring, an approximation must be made. In every test made, the shrinkage appeared almost linear during the first 60 minutes so that the shape of the curve can be extrapolated back to zero time.

The maximum shrinkage found after 3 hours of testing was about 3.3 percent. Extended tests have shown that after several days, the total shrinkage may exceed 5 percent of the original volume. An empirical equation has been derived from the data taken during the test to predict the shrinkage after any given period of time. This equation is based on the assumption that a time-shrinkage curve becomes asymptotic to a maximum shrinkage value. However, insufficient work has been done to determine what the maximum shrinkage value is.

**Linear Shrinkage:** Apparatus used to determine linear shrinkage consists of a 36-inch-long mild-steel test mold with a  $\frac{1}{2}$ -inch-radius trough and a micrometer filar microscope, *Fig. 5*. The mold is closed at both ends and provision is made for securing the cast specimen to one end of the mold while the opposite end of the casting is allowed to remain free. The microscope is used to measure the movement of the free end of the specimen.

The mold is prepared by coating the trough, finished to 4 microinches, rms, with a thin film of mineral oil. A thin plastic film is then laid in the

trough and freed from wrinkles; the plastic and the oil film working together, minimize any tendency for seizure. The surface of the plastic film that will be in contact with the specimen is coated with a paste wax. Then, the brass index plug is mounted in the mold so the microscopic index line scribed in the plug registers between the double filar in the microscope. After the plastic is poured, readings are taken with the microscope at regular intervals. Plotted data of a typical test are shown in *Fig. 6*.

Results of this test indicate that no linear shrinkage is detectable until the end of  $3\frac{1}{2}$  hours; that is, until the time of solidification of the plastic. At this time, the material began to shrink and continued to shrink at a constantly decreasing rate until the specimen was removed from the mold. The total shrinkage at the end of 48 hours was about 0.001 inch per inch of length. Extended tests indicated that after 10 days there was still a slight amount of shrinkage occurring.

Results have shown conclusively that this test can give no indication of linear shrinkage until the plastic reaches the gelation period. The plastic

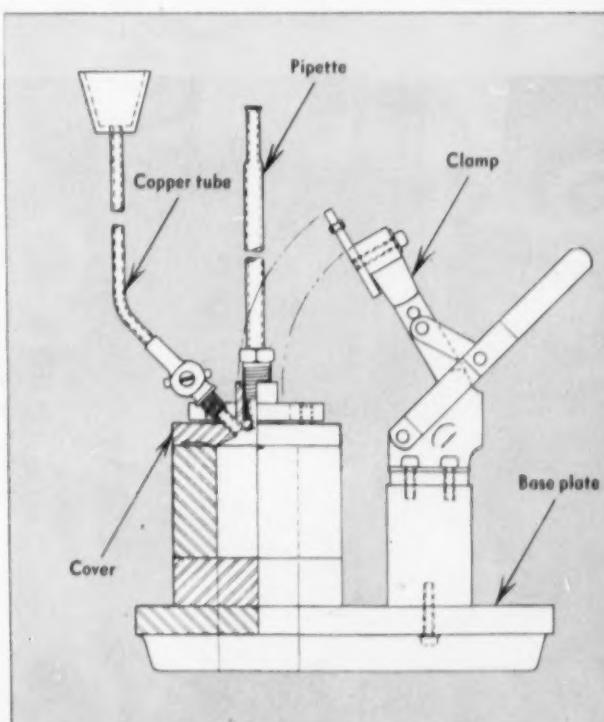


Fig. 3. Special apparatus designed to measure the volumetric shrinkage of a sample of plastic. Light mineral oil in the pipette drips down to replace the shrinking plastic in the mold. The volume of shrinkage is determined by pipette readings.



# research report

is obviously shrinking from the time the hardener is added, but because of its fluid state, it continues to flow to the confines of the mold and shrinkage occurs from the unrestricted surface. The top surface sank  $\frac{1}{16}$  inch before any shrinkage was detectable in the longitudinal direction.

**Conclusions:** Two practical tests have been developed for determining the shrinkage characteristics of unfilled epoxy resin and a particular hardener. Much more work is necessary before these tests could be defined as "standard" tests. Both users and producers will have to help in evalu-

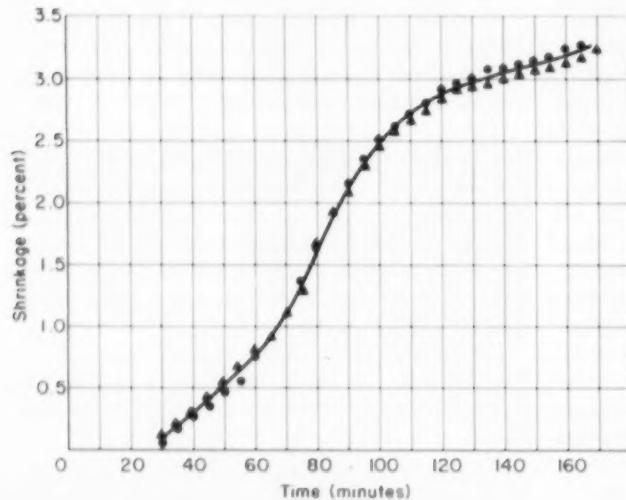
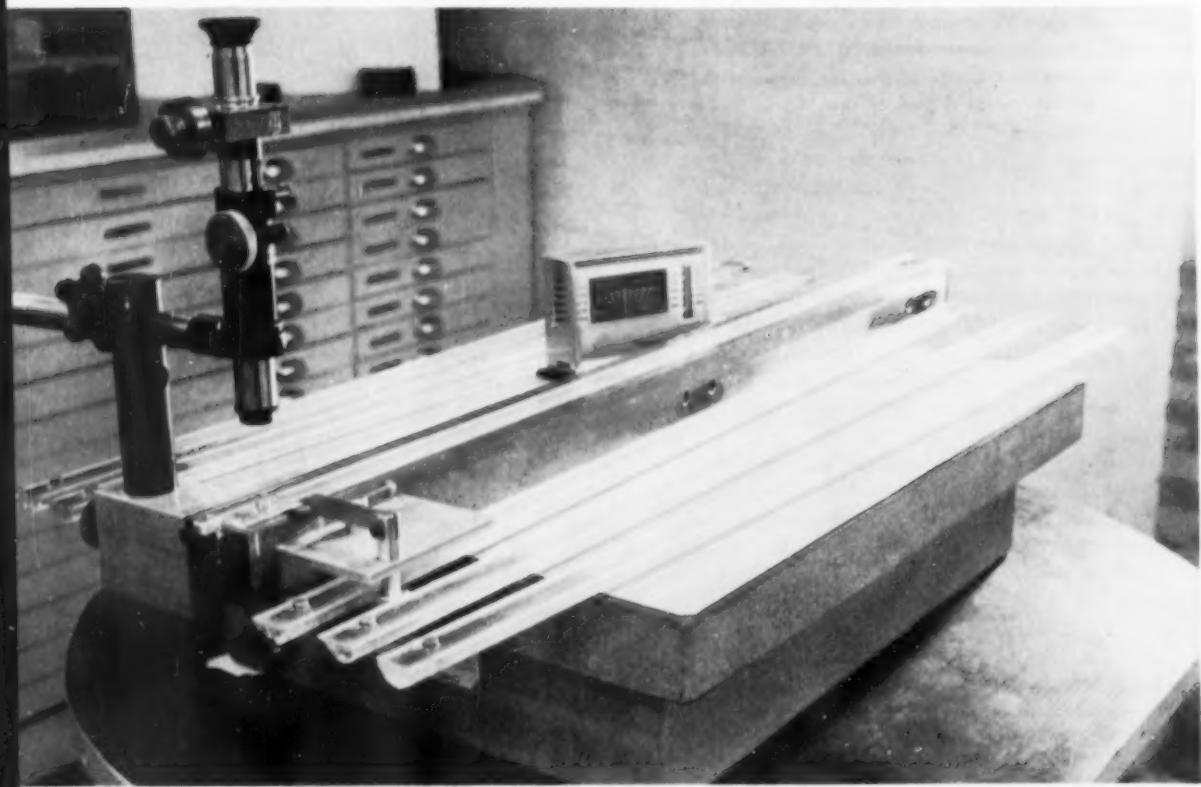


Fig. 4 (left). Typical volumetric shrinkage test results. Tests were conducted in pairs and curves were averaged.

Fig. 5 (below). Apparatus for measuring linear shrinkage, after gelation has started, includes a microscope. As the one free end of the test specimen shrinks back, the microscope is used to determine the movement. A brass plug in the specimen provides the reference point.



ation of the procedures outlined. However, these tests should form a basis for the next action.

Several points concerning these tests should be borne in mind. Exothermic heat, for example, has been excluded as a condition of these tests. The resin has been tested in small batches so that exothermic heat would not build up and represent a problem. Where tools are to be massive, test results will have to be interpreted for actual conditions or will have to be adapted to provide the required information.

Also, it will be necessary to set up and adopt a glossary so that every person coming in contact with tests or test results will obtain one, and only one meaning, from an interchange of results. Repeated tests throughout this project have shown that the shrinkage rate is greatest during the setting period. If shrinkage is to be accurately evaluated and reported, it must be investigated from the time the hardener is added to the resin. Mathematically, the relationship between linear and volumetric shrinkage is 1 to 3, but this relationship is valid only if shrinkage for the same part of the curing cycle is under consideration.

The closed mold is advantageous because it pro-

vides a means of obtaining data almost instantly after mixing. The trough type mold affords the advantage that extremely accurate measurements can be made on shrinkage over a long period of time. It, however, gives no indication of shrinkage prior to the setting of the plastic.

Actually, the shrinkage of tool plastics should be thought of as taking place in three distinct phases. Initial shrinkage occurs at the unrestricted surface while the plastic is fluid. While the plastic is in the semisolid state, it is too solid to flow to the confines of the mold but not strong enough to overcome the adhesion to the sides of a mold or friction on a surface. The final shrinkage phase takes place after the plastic is set to the point where it is strong enough to overcome adhesion and friction effects.

From the work done on this research project, it can be definitely concluded that shrinkage in plastics is a complex phenomenon but that valid tests can be developed to predict the extent of shrinkage that will occur in various types of tools. Cooperative study and logical extension of these results will lead to a better understanding between producers and users, and to better plastic tools.

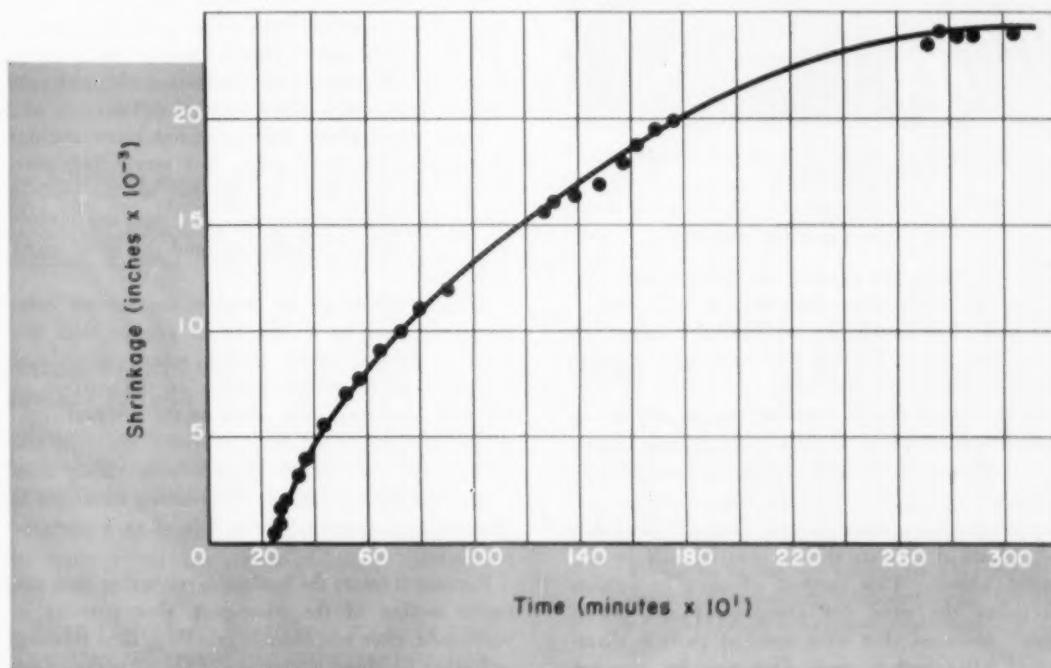


Fig. 6. Typical linear shrinkage test results. Unevenness of the plotted points is caused by the effects of adhesion and friction. As the plastic becomes strong enough to reduce the effects of these two characteristics, the curve smoothes out.



Operator loads jet blades in work-holding fixture of airless shot peening machine.

**S**HOT PEENING JET ENGINE compressor blades has become a production operation on a conveyorized line. The installation, at Ex-Cell-O Corp., Elwood, Ind. Plant, handles both steel and titanium blades in eleven different sizes.

In the setup, the workpieces are carried on an endless belt conveyor, shown in the accompanying photo. The operator loads and unloads each blade-holding fixture as it passes his station. In the system, designed by Wheelabrator Corp., Mishawaka, Ind., blasts of shot are thrown centrifugally by six, bladed wheels. This method of shot propulsion eliminates the need for compressed air. Heat-treated cast-steel shot with nominal particle diameter of 0.011 inch is used. This type has ricochet qualities that permit more inaccessible areas of the work to be reached.

The work-holding fixtures are box type, fastened to the conveyor belt. These fixtures mask all sur-

# shot peening

## improves jet blades

faces of the work from the blast except the key or root sections, which are to be strengthened.

Highest timed production rate for this semiautomatic setup, with one operator in one shift is 1671 blades in the 8-hour period. Blades are peened to specifications ranging from 0.007 to 0.011 inch arc height, measured on the Almen A-2 gage.

Shot peening of the jet blade roots is utilized because it results in greater fatigue strength of this critical area. Each shot striking the surface of the metal makes a small dent, and stretches the surface radially. This causes plastic flow of the surface fibers of the blade beyond their yield point in tension, and cold works a layer of metal.

Since metal fibers under the top layer are not stretched to the yield point, they retain their elasticity. Because they are bonded to the surface fibers, an equilibrium results that puts the surface fibers in residual compression and the inner fibers in tension.

This is advantageous because the surface compression stress is several times greater than the interior tension stress. Thus when operational stresses tend to impose tension on the surface of the part, that tension is offset by the residual compression stress in the surface layer. Since fatigue failures generally result from tension rather than from compressive stresses, shot peening treatment is effective in increasing service life of such parts as jet blades.

Because it treats the surface layer rather than the entire section of the piece-part, shot peening is performed after machining, grinding, heat treating and other finishing operations. Otherwise the effect of the peening might be cancelled. Only one other production process is performed after peening. Blades are coated with graphite varnish for protection during shipment.

# design and drafting standards

## .... for jigs and fixtures

By Arthur F. Hird

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Harrington & Richardson, Inc.  
Worcester 10, Mass.

Most companies making jigs and fixtures utilize design and drafting standards of some kind. Often these standards are informal; in some cases, however, individual companies have developed and published comprehensive standard books.

While it is possible to develop standards covering nearly every design or drafting problem encountered in jig and fixture work, overly detailed standards are often hard to use and may restrict the ingenuity of the designer. Ideally, standards should be as concise as possible and should be published in a form which facilitates ready reference.

The following standards were developed by engineers at Harrington & Richardson, Inc. for their own use. Although these standards are not universally applicable, they will be of considerable interest to other companies planning to establish jig and fixture design and drafting standards.

### DESIGN STANDARDS

#### Jigs and Fixtures

**Construction:** Jigs and fixtures should be made as rigid and strong as possible. Do not under-design knobs, bases and similar components.

**Holes:** Relieve all long dowel pin holes to facilitate reaming and easy removal of pins. All tapped holes should be countersunk.

**Wear Plates:** All wear plates are to be made of hardened-and-ground tool steel or pack-hardened machine steel.

**Locating Points:** Locating points for the workpiece should be as far apart as permitted by the workpiece design and should be as small as is

consistent with good support and anticipated wear.  
Also:

- Locating points must be surfaces or holes which are not apt to vary dimensionally.
- The same locating points should be used for as many operations as possible.
- Burrs on the workpiece should be considered when selecting locating points. Locating points should be in burr-free areas if possible.
- Chip pockets should be avoided on locating points.
- When designing fixtures for round work, use V-shaped locating surfaces in preference

## REFERENCE SHEET

to other shapes. Preferably, the angle of the "V" should be 90 deg. Consider using tool steel wear plates on the locating surfaces.

**Sharp Edges:** Call for removing all sharp edges on jigs, fixtures or gages where they might cause injury to operators.

**Eyebolts:** Provide  $\frac{1}{2}$ "-13 tapped holes for eyebolts on all fixtures weighing 50 lb. or more. The eyebolts will facilitate lifting the fixture.

**Milling Fixtures:** The thrust of milling cutters should always be directed against a solid member. When designing fixtures for milling several pieces simultaneously, climb milling is recommended, since it results in better cutter life and forces the workpiece down rather than lifting it from its clamped position. However, not all machines are designed for climb milling and the machine design should be evaluated before climb-milling fixtures are designed. Also:

- Use standard commercial vises when possible.
- When a workpiece is to be loaded onto a vise jaw or fixture and located on two pins, one of the pins should be diamond-shaped to facilitate easy loading and removal of the workpiece. If possible, one pin should be removable or a mechanical ejector provided for the workpiece.
- Vise jaws should be designed so that the workpiece is held by the pressure of the vise itself. On small parts, minimum jaw clearance is recommended.
- Depending on the type of vise, a chamfer is necessary on the bottom inside area of one or both of the vise jaws. If no chamfer is provided, proper seating of the jaws is impossible.
- All milling should be against the fixed jaw. Avoid putting locating pins or blocks on the movable jaw.
- When it is not possible to clamp work well within the vise, a size block a few thousandths of an inch smaller than the minimum thickness of the workpiece should be mounted on the bottom portion of the fixed jaw to prevent canting of the jaws under pressure.
- Make certain that cutter, arbors, collars and overarm support will clear the vise jaws and fixture.

• Clamp screws and buttons should be designed so that there is no possibility of their catching the operator's hand and holding it in the path of the cutters.

**Clamping Mechanisms:** Design of clamping mechanisms should be kept as simple as possible. Use of spherical washers and supporting springs is advisable.

**Locating Pins:** All locating pins, studs and other perishable parts in jigs, fixtures and gages should be readily replaceable. Provide knockout holes if possible.

**Air Cylinders:** Use standard air cylinders where practicable.

**Bushings:** Use standard commercial bushings, dowel pins, clamps and similar items wherever possible.

**Checking:** When a design has been completed, check for ease of loading and unloading; also for cleaning of locating surfaces and for simplicity of construction and operation.

### Cutting Tools

Try to use standard cutters, end mills, reamers and similar tools. If it is not possible to use a standard cutter, consider the possibility of altering a standard cutter to fit the job requirements.

**Milling-Cutter Diameters:** Do not specify a milling-cutter diameter which is larger than necessary, but keep in mind that cutter diameters are reduced by grinding.

**Basic Cutter Dimensions:** To establish basic cutter dimensions for milling cutters, special reamers and similar tools, subtract 25 percent of the work tolerance from the maximum work dimension. The resulting figure will be the basic cutter dimension.

**EXAMPLE:** A component dimension is 1.000 inch,  $+0.004, -0.000$ . The maximum work dimension is 1.004 inches. Twenty-five percent of the 0.004-inch tolerance is 0.001 inch. Subtracting 0.001 inch from 1.004 inches, the basic cutter dimension is 1.003 inches.

The method of applying tolerances to the basic cutter dimension will depend on the setup in question and total workpiece tolerances. In most cases, the cutter tolerance will be on the minus side to avoid the possibility of cutting wider than the maximum work dimension in the event of cutter runout.

## Gages

**Plug Gages:** Use standard commercial plug gages, rather than special plug gages, whenever possible. "Go" and "Not-Go" dimensions and drawing number will be stamped on all plug gages.

**Indicator Gages:** Use standard commercial dial indicators, rather than flush-pin gages, whenever possible. Flush-pin gages should never be used to measure tolerances smaller than 0.005 inch. Master setup gages are to be supplied with all types of indicator gages. Provision should be made for mounting the master gage on the gage proper by means of one or two cap screws. Dimensions and drawing numbers are to be stamped on master gages.

**Snap Gages:** Use standard commercial snap gages, rather than special snap gages, whenever possible. "Go" and "Not-Go" dimensions and drawing numbers will be stamped on all snap gages. If it is necessary to fabricate a snap gage, the end having the "Go" or maximum dimension will have a chamfer and the "Not-Go" end will have a radius.

**Thread Gages:** In specifying all "Go" thread gages, use Table Y on page 38 of "Screw Thread Standards for Federal Services." Use Table X on the same page for "Not-Go" thread gages.

**Gage Tolerances:** Gage tolerances are based on workpiece tolerances. To establish a "gagemaker's tolerance," take 10 percent of the workpiece tolerance and assign one-half of this figure to the "Maximum" dimension and one-half to the "Minimum" dimension. The "Maximum" gage dimension should have a minus gagemaker's tolerance. The "Minimum" gage dimension should have a plus gagemaker's tolerance.

**EXAMPLE:** A component dimension is 1.000 inch,  $+0.000, -0.004$ . Ten percent of the work tolerance is 0.0004 inch. Half of this number is 0.0002 inch. Thus the "Maximum" gage dimension is 1.004 inches,  $+0.0000, -0.0002$  and the "Minimum" dimension will be 1.000 inch,  $+0.0002, -0.0000$ .

**Weldments:** Do not use weldments for gage construction.

## Heat Treating

**Cutting Tools:** Broaches and rifling cutters (high-speed steel) will be hardened to  $R_C$  65-66. All other high-speed steel tools will be hardened to  $R_C$  63-65.

## Gages, Set Blocks, Templates, Wear Plates:

Unless sections are too thin, all gages, set blocks, templates, wear plates and similar parts will be hardened to a minimum of  $R_C$  63. If these parts are made of pack-hardened steel, minimum hardness is  $R_A$  79.

## DRAFTING STANDARDS

### Lines

**Line Thickness:** On all drawings, object lines must be heavy. Dimension lines should be lighter than object lines but heavy enough to make good blueprints.

**Dimension Lines:** When designing component parts, every effort should be made to run dimension lines from designated points such as two surfaces or a pivot hole. The manufacture of the part must be taken into consideration in establishing these points.

**Phantom Lines:** Draw phantom outlines of cutters, arbors and sleeves on all fixtures. Indicate the direction of rotation of the cutters. Draw phantom outlines of the workpiece on all jig, fixture and gage drawings.

### Assembly Drawings

**Bushings and Liners:** Show bushings and liners on assembly drawings with double broken-cross-hatch lines.

**Screws:** Screws will be shown with two solid lines. Use two broken lines when screws are hidden.

**Springs:** Show springs as a cross filling the intended area.

**Identification of Items:** In assembly views individual items should be identified by a number inside a circle.

**Hole Size and Fit:** In noting the size or fit of holes in an assembly view also designate from which item those holes are located.

**EXAMPLE:**  $\frac{3}{8}$ "-20 thread, 2 holes, located from Item 6.

**Detail Sheets:** If a design is not complicated, all notes and drawings should be put on the assembly drawing proper. Avoid the use of detail sheets.

**Bushings:** Locations of all bushings will be dimensioned on assembly drawings.

## REFERENCE SHEET

**Hidden Views:** Assembly drawings should be suitable for use by operators. Do not complicate assembly drawings by hidden views for dowels and screws and do not repeat details in projected views.

**Drawing Numbers:** Call for "stamp drawing number" on assembly sheets, also stamp identification on each component part of jigs and fixtures.

### Component-Part Drawings

**Grinding and Finishing Marks:** The grinding mark "G" should be shown on all ground surfaces. The finishing mark "F" should be shown on machined surfaces only.

**Actual-Size Views:** On component part drawings where size is not actual, show an actual-size view in the upper left-hand corner of the drawing and identify it as such.

### Stock or Standard Items

**Stock Sizes:** Stock sizes are to be called for on the Bill of Material only.

**Detailing Standard Items:** Standard bushings, liners, lock screws, clamps, keys and similar items are not to be detailed. Listing the commercial item, manufacturer's catalog number and manufacturer's description is adequate.

### Gages

**Standard Drawings:** Rather than drawing standard plug gages, snap gages and similar items, use standard sepia drawings to save drafting time.

**Identification:** Call for stamped identification of all components of gages which have loose parts.

### Weldments

When using weldments for fixtures, the design of the welded assembly is to be considered a unit detail. List stock sizes on the drawing and call for "weldment" in the material list. Indicate where welds are required. Add note "Normalize after welding and before machining" on all drawings.

### Revised and Superseded Drawings

**Revised Drawings:** When a revision is made on a drawing, the revision must be checked by a responsible person other than the one who made the revision.

**Superseded Drawings:** Drawings to be superseded must be identified by a red seal, placed on the bottom right-hand corner of the drawing. There must also be a note on the superseded drawing giving the number and date of the new drawing. The new drawing must have a note indicating number and date of the drawing which it supersedes.

## Metal Stamping Drafting Standards

Copies of Section 10, American Drafting Standards Manual, are now being distributed for review. The purpose of this section is to indicate basic preferred design and drafting practices related to metal stampings. In its preparation an attempt has been made to provide a means for imparting general design knowledge acquired by various manufacturers of metal stampings over a period of years.

The contents cover practices commonly used by small parts manufacturers in the production of stampings on standard types of punch presses. Such items as air frames, air foils, automobile bodies, car building, sheet metal piping and ductwork, and similar large sheet metal products are omitted. Both cutting and forming are covered in the standard.

Cutting data includes blanking, nesting of blanks, radii on blanked parts, pierced and drawn holes, die clearances, trimming, shaving and burnishing, cutting off, and notching. Material forming data includes bending, forming, embossing, drawing, coining, swaging, extruding, ironing, bulging, and curling. Nomenclature and terms are defined and the text of the standard is supplemented by 62 illustrations.

The standard is tentative and subject to revision. Tool engineers who wish to review the standard, which is published by the American Society of Mechanical Engineers, can obtain copies by writing to Mr. Frank Philippbar, Standards Department, ASME, 29 West 39th St., New York 18, N. Y.

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# Philadelphia 1958



**ASTE Convention and Tool Show  
invite YOU  
to invest in the future**

## Philadelphia 1958



Host Committee Chairman Edward H. Wheeler conducts the planning meeting held at the Engineers Club in Philadelphia. From left are: Karl G. Nowak, vice chairman of the National Program Committee; Richard Bacik, convention manager; and Harry A. Paine, chairman of the National Program Committee.

# Philadelphians

Pitching right in with a wealth of ideas for the 1958 Convention are its Philadelphia Hosts. Under the able chairmanship of Edward Wheeler, the committee has already launched a wide range of projects which will ensure a smooth-running Convention and, in addition, has invited hundreds of members in the Middle Atlantic States to help man ASTE's largest show to date.

At their combined meeting with the National Program Committee September 20, various Host Chapter Committee chairmen reported the progress of plans for activities and arrangements for the forthcoming Convention. Among the subjects under discussion were: provisions for tickets; transportation and publicity; arrangements for plant tours, technical sessions and women's activities; and plans for setting up a budget and a system for records and reports.

The hosts are planning a Philadelphian welcome for thousands of engineers who will be attending the Show and Annual Meeting. Visitors will find a curious blend of the past and future, including such widely varying sights as the Navy Yard with its rocket ships and historical 200-year-old streets.

Tours of historic shrines and modern museums, the first zoo and a famous arboretum, homes as they were in Colonial days, will be available to visitors for the asking.

Other places of interest are: Franklin Institute, which should appeal to tool engineers interested in gadgets and mechanics, printing presses or stars; the Pennsylvania Academy of Fine Arts, the oldest art school in the country; the Commercial Museum, which has exhibits from Latin America, Africa, China, Japan, the Philippines, and other countries; the Philadelphia Art Museum, which manages the Rodin Museum; the Atwater Kent Museum with permanent exhibits which graphically recount phases of Philadelphia's 300 years; and Fels Planetarium.

Visiting engineers, their wives and guests will be seeing the Liberty Bell, Independence Hall, Carpenters' Hall and Betsy Ross House, and the United States Mint. More than 22 outstanding industrial plants will open their doors for guided tours which will provide close-ups of plant operations.

A royal welcome is awaiting all those who plan to attend ASTE's 1958 Show and Annual Meeting, which will be the biggest and best to date.



Pictured as they discuss "Division A's" plans for the Show are from left: Mrs. Paul E. Rague, secretary of ladies' activities; Robert Wendig, coordinator; Frank McCarthy, in charge of transportation; Mrs. Robert Griffith, co-chairman, ladies' activities; Harry Lueders, handling plant tours; Bill Moore, division coordinator; Leonard Horoff, in charge of tickets; and Mrs. William Griffith, ladies' activities chairman.

## Plan Royal Welcome



Division "B" Coordinator Harland O. Fullam, left, confers with George F. Bain, Jr., technical sessions co-chairman; Paul Mochel, emergency co-chairman; Walter L. DeMaris, technical sessions chairman; Robert Schwing, sessions arrangements chairman; and Albert C. Straub, emergency chairman.



Reading over Eric Lund's shoulder, are from left: Campbell R. Pittsinger, budget chairman; Harry D. Wood, publicity chairman; and seated, William J. Dietrich, records and reports chairman. Mr. Lund is Division "C" Coordinator for the forthcoming 1958 Convention.

## Philadelphia 1958



Philadelphia's Convention Center represents seven and a half acres of floor space and the best of physical facilities for hundreds of machinery displays at the ASTE Tool Show.

# Show Time Is Idea Time

An idea mart of almost limitless scope awaits the tool engineer who attends the 1958 ASTE Tool Show in Philadelphia. For a modest investment, he will be exposed to more ideas than he could use in a lifetime. Somewhere among the seven and a half acres of production machinery and equipment displayed in Philadelphia's Convention Center, will be the one idea he may be needing next. From among the people he will meet, and from technical sessions he will attend, will come other ideas with both current and future value for him in his profession. In short, he can hardly afford to stay away from this, the best and most forward-looking Tool Show staged since the first one in 1938.

Time is money, in today's economy. The fact that all this modern equipment is gathered together under one roof, and displayed under the best possible physical conditions (with the exception of actual installation) saves the idea shopper untold hours of travel both within the United States and outside the continent, thus saving his company unnecessary expense. No finer showcase could be provided than the five great halls in the Convention Center, where convenience is paired with the best possible facilities, and organization is the keynote.

Recently modernized at a cost of more than a million dollars, the Convention Center incorporates excellent lighting, ease of traffic flow, and improved

accessibility to both ends of the building from the outside. Adjoining conference rooms for technical sessions provide another timesaver for the busy convention-goer. The Center is easily reached by rail and car, for the convenience of the exhibitor as well as the visitor.

Focal point of a two-hundred-mile circle encompassing 26 percent of the nation's industry, Philadelphia can be counted on to attract thousands of visitors from this area, as well as from the rest of the United States and beyond. From men schooled in the use of giant metal-forming presses to those having an intimate working knowledge of the latest automatic machining devices, every kind of expert will be represented. So too, will the products and processes they work with. With such a store of information ready to be tapped, technical sessions and informal Show-time discussions should provide an interchange of technical knowledge and ideas second to none.

#### **Symposium on Metal Cutting Offered**

High point of an excellent program of technical sessions will be a symposium on metal cutting. Planned with the practicing tool engineer in mind, the five-session symposium will provide a review of the subject, balancing both the theoretical and practical aspects of metal cutting. The presentation is made with a view to best putting present knowledge into practice for increased profit and efficiency.

As a follow-up to the symposium, a three-session report on metal-cutting research will appear on the technical session roster, with two of the three sessions composed of reports from the Battelle Memorial Institute literature survey, sponsored by the ASTE Research Fund. Also, among the 75 papers scheduled for presentation will be a collection of reports on automation in general and the tape-control methods of automatic machining.

**Inside the Convention Center, men mingle with machinery, attend technical sessions, talk to experts, and bring home a wealth of technical information for future reference as well as for their present needs.**



# Sacramento joins ASTE ranks

Friday the 13th, long labeled by superstition as an unlucky day, proved to be the opposite for ASTE's 145th chapter, Sacramento. In realizing its chapterhood on that date in September, Sacramento achieved the goal of a mid-September chartering date set last February by its organizers.

The well-planned ceremonies brought forth compliments from National Director G. Ben Berlien, who acted as chartering officer. Two items showed an unusual amount of advance planning on the part of its members. Laminated name badges were prepared for all members and honored guests, and special badges for visitors. In addition, the chapter had printed and distributed on charter night, Volume I, Number I, of a program and news bulletin titled "The Tool Bit." This will be published monthly and mailed to members.

One hundred thirty seven persons attended the chartering. Honored guests included Max Gillis, legislative secretary representing California's governor, Goodwin J. Knight; R. J. Mill, Manufactur-

ing Division manager of Aerojet General Corporation; Francis H. Stevenson, superintendent of Aerojet's Welding and Sheet Metal Division and national director of the American Welding Society; Phil Freeman, Golden Gate chapter chairman; and Col. Schmidt, director of maintenance, McClellan Air Force Base, Sacramento. Besides these and other honored guests pictured, 20 members from Golden Gate chapter and 10 from Santa Clara attended the festivities.

In a brief ceremony, Mayor Azevedo presented the Key to the City of Sacramento to Chairman Joe Oviatt, and welcomed the new chapter to the city, promising support to any proposed civic activities it might plan. Max Gillis, representing Governor Knight, extended congratulations from the capitol.

Professor Frederick Preator, head of the Tool Engineering Department at Utah State Agricultural College, was speaker for the evening. His talk was on professional engineering and education.

**National Director G. Ben Berlien, left, administers the oath of office to Sacramento's first set of officers who are, from left: Joseph L. Oviatt, chairman; Joseph R. Koch, first vice chairman; Arthur S. Dzigorski, second vice chairman; Robert E. Dailey, secretary; and Richard D. Thompson, treasurer.**



Ralph Chrissie, left, vice chairman of the National Membership Committee, greets Dave Gustafson, National Editorial Committeeman from Golden Gate, sponsoring chapter, while Sacramento Vice Chairman Art Dzigorski, second left, discusses the chartering details with Chairman Joe Oviatt.



Lined up to congratulate Sacramento's first chairman, Joe Oviatt, right, are, from left: Frederick Preator, National Education Committeeman; Ralph Chrissie, vice chairman of the National Membership Committee; Chapter Vice Chairman Art Dzigorski; Lawrence H. Cook, Santa Clara chapter chairman; Arthur Lewis, San Fernando's charter chairman; and Ray Garriss and James Medford, past and present chairman of Long Beach.

Sacramento's Mayor Clarence L. Azevedo, left, presents the key to his city to Joseph L. Oviatt, charter chairman of ASTE's newest chapter, at chartering ceremonies.





Roy A. Lindberg, associate professor, mechanical engineering, points out a question to Speaker C. F. Rathzak. Looking on from left are: John L. Anderson; Jack T. Murray, past Madison chairman; George R. Sell, Institute Coordinator, standing; and John A. Evans.

## Engineers Go Back To School

### University of Wisconsin

Speakers Thuma and McGee, left, engage in a lively discussion characteristic of the informal chats before and after lectures at the Institute. Preparing to add their comments are, left, Robert Loetscher, from the University; Douglas Von Hoff and Jack Kennedy, both representing Giddings & Lewis Machine Tool Company.



**K**eepering the engineer on his toes these days—a prime responsibility of the American Society of Tool Engineers—stimulated Madison chapter to take an active part in the University of Wisconsin's Engineering Institute, September 25-27.

Under the direction of the chapter's education committee chairman, George Sell, who is also Institute Coordinator, an intensely interesting and up-to-the-minute program was arranged, combining those topics in which participants expressed great interest and by which they could most benefit. Through such institutes as this, the school endeavors to further the continuous education of technically trained and professional engineering personnel.

Over 45 in number, these back-to-school engineers, including production supervisors, tool, plant and manufacturing engineers, participated in lively discussion groups, and observed slides and movie presentations which supplemented the lectures.

The first session, "Cost Reduction and Tool Engineering Work," was conducted by Harry Conn, Chicago chapter, of Scully-Jones & Company. Other topics included a discussion of "Toolroom Operation," by O. F. Rendenbach, A. O. Smith Corporation; "Short Run Tooling," with panelists, John L. Anderson, chief estimator, Gisholt Machine Company; and John A. Evans and C. F. Rathzak, tool engineers with Kenworth Manufacturing Company.

ASTE supplied the Institute with several speakers on the second day of the conference, also, including



Robert Ratner, left, Director of Institutes, looks on as Speaker David Crew, who has finished his lecture, prepares to answer a question posed by Madison's J. H. Kellogg of Parker Pen.

Chicago member R. W. Gardner, senior sales engineer, Verson Allsteel Press Company, who delivered a talk on presswork problems; and Madison's E. C. Helmke, assistant chief engineer, Gisholt Machine Company, whose topic was "Developments in New Machining Operations." Following the talk by David Crew, corporate staff assistant, Sundstrand Machine

Observing a display are J. L. Smith, left, Viking Pump Company; Sydney Glossop, United States Ordnance Corps; Frank Van Der May, Johnson Service; Speaker R. W. Gardner; and Alfred O. Farrar of Baker & Company, Incorporated, who is a member of Paterson chapter in New Jersey.





Tool Company, on "Economics of Machine Replacement," the Institute adjourned until the Madison-sponsored chapter dinner meeting, at which Howard L. Roat, director of production engineering, A C Spark Plug Division, discussed "Applying Creativity to Production Engineering."

Speakers on the last day of the conference included Richard Thuma, superintendent, Tools and Maintenance Section, Allis-Chalmers Manufacturing Company, on "Jig and Fixture Design"; Harold McGee, Machine Tool Division, Sundstrand Machine Tool Company, on "Tool Design for Special Jobs"; and John O. Lenz, senior process engineer, Minneapolis-Honeywell Regulator Company, who discussed "Tool and Die Estimating."

William P. Samp, Perfex Corp., left, and J. H. Peterson, A C Spark Plug, study a problem with Speaker E. C. Helmke, Madison.



Harry Conn, second from left, chief engineer, Scully-Jones, answers questions about his slide presentation. From left are: Kenneth Damschen, Mr. Conn, George Kureczek, L. Sokoll, and Otto Rendenbach.

Madison Chairman Arvil Mergen, left, chats with George Landpearl, coffee speaker, and James Flaherty, program director.



## CALUMET

Harry Conn, chief engineer of Scully-Jones & Company, talked on "The Economics of Tooling and Manufacturing" at the September 23 meeting.

## EVANSVILLE

J. F. Moore presented a talk to the chapter on "Gating of Plastics in Injection Molds."

## FOX RIVER VALLEY

"Coil-Fed Automatic Machines" was the topic Emil Widmer, manager of Machinery International Division of Cosa Corporation, chose to speak on at the September 24 meeting.

## KALAMAZOO

Following a trip through the Latex Compounds, Incorporated, Kalamazoo chapter heard Robert Lees, plant manager of the Schoolcraft Plant, Schoolcraft, Michigan, lecture on the manufacture of sponge rubber at the September 26 meeting.

## KANSAS CITY

The Midwest Machine Tool Show, sponsored by Ellfeldt Machinery & Supply Company, was the main topic under discussion at the October 1 ASTE Night meeting. Over \$500,000 worth of machinery and equipment from over forty different machine tool builders was exhibited under power and demonstrated by factory engineers.

## MISSISSIPPI

"Centerless Grinding" was under discussion at Mississippi's September 9 meeting. Paul Gruber, engineering development head, Cincinnati Grinder Company, outlined types of work and material which can be ground and tolerances which can be controlled.

## MONMOUTH

An informal get-together was held by Monmouth chapter for the purpose of having a general discussion of projected chapter plans for the 1957-58 year. The meeting was held on September 8 at the Old Orchard Restaurant in Eatontown, New Jersey.

## NORTHERN NEW JERSEY

General Charles B. Duff, Commander 52 of the AAA Brigade in the U. S. Army lectured to the chapter on guided missiles. A colored movie entitled "Nike Ajax" by Douglas Aircraft was shown. In addition, two short films were also shown to illustrate improvements which have been made since the Nike missile system was put into operation.

## NEBRASKA

Over 85 percent of the membership, 90 couples, turned out for the Annual Ladies Night at the Birchwood Club. Highlights of the evening were corsages for the ladies, door prizes, dancing, and a steak dinner for everybody.

## PORLAND, ME.

Harold P. Granger, district manager for The Bellows Company, spoke to the chapter on "General Applications for Controlled Air Power" at their October 4 meeting.

## WESTERN RESERVE

A plant tour of the Reliance Electric and Engineering Company was on the agenda for the September 24 meeting. The chapter saw one of the most modern electric motor manufacturing assembly lines in the country. Sixty-five members were present.

Chips  
and  
Chatter



ERIE—Engineers at the American Sterilizer Company are shown following a tour of their plant. From left, they are: H. E. Paden, who delivered a talk; R. M. Kosmala; H. W. Sedler, chairman; J. T. Stoica; S. A. Fioenzo, first vice chairman; S. E. Zirkle; and C. J. Miller.

—Leo B. Weiner

## Hamilton Plant Tour

Over 253 members and their guests traveled to Welland by bus to Atlas Steels Ltd. A buffet supper was held at the Rose Villa Inn under the direction of R. A. Ellis, who is a member of the chapter and Hamilton manager of Atlas Steels. Attending the event were the following executives of Atlas Steels: George De Young, president; William Thomas, vice president and works manager; Fred Lockhart, vice president and general sales manager; and Len Bailey, vice president. Following the dinner, a draw for a chest of stainless steel cutlery was won by Charles Sandilands.

Atlas Steels Ltd. is one of Canada's largest producers of specialty steels and the visitors were able to see the production of various types of tool steels made by the company. A highlight of the tour was a visit to the continuous casting machine, which was the first machine of this type on the continent for the commercial production of specialty steels. Visitors were also able to see the production of stainless steel sheets, strip and tubes which are another specialty of the company.

Atlas is Canada's only producer of stainless steel sheet and plate and until the company went into production of these items in 1950 Canadian fabricators and manufacturers were dependent on foreign sources, chiefly the United States, for their supply of flat rolled stainless steel. A hot planetary mill and Sendzimir cold reduction mill, two units which are unique in the Canadian steel industry, are used in the production of stainless steel sheets and plate.

—Russ Wilson

## Film at Philadelphia

The first technical meeting of the fall season in Philadelphia was marked by an attendance of 75 members and guests, a buffet dinner and a short film, "Time out for Jimmy," in addition to the regular technical session. This film was presented in the interest of the United Fund Drive.

The technical part of the program was devoted to a forty-minute color film, describing the automated production of refrigerator housings for Chrysler Corporation, and presented by T. W. Farren, sales manager for Michigan Drill Head Company.

The film showed how the housings are drilled, tapped, reamed, milled, bored, inspected and washed, all automatically, on a transfer type machine.

## Keystone Hears Mosher

Donald Mosher, member of Elmira chapter and president of the B.M.T. Manufacturing Company, discussed precision barrel finishing at a recent meeting. Over 30 chapter members listened to Mr. Mosher's talk on the principle of slide honing and barrel finishing. He demonstrated that parts could be cleaned in tumble barrel while being honed finished by proper selection of media. Mr. Mosher emphasized the importance of maintaining records in barrel tumbling room for future reference in improving barrel-finishing techniques. A panel board display and midget multitumbling barrel were on exhibit.

—Frank Forquer

## Accuracy at Dayton

B. D. Witemeyer, general manager of the Fixed Gage & Inspection Room Instrument Division, Sheffield Corporation, discussed functions of the divisions of Sheffield Corporation at a recent Dayton chapter meeting.

Following his discussion, Mr. Witemeyer went on to the main topic of the evening—the five echelons of accuracy. He showed by means of slides the types of gages required for each level of inspection, starting with fixed gages and progressing through to the comparator type gages, air gaging, including various types of jets and the plunjet cartridge, specially designed gages, such as the piston sorter, classifying gages, and connecting rod straightener.

As production accuracy requirements increase, it is necessary, Mr. Witemeyer stressed, that gage accuracy be increased by use of electronic amplifiers in the electronic comparator and gage block comparator.

## Salt Lake City Outing

Boxelder Flats in Mill Creek Canyon was the scene of Salt Lake City's annual chapter outing. Spirit ran high as teams and individual contestants participated in the games and activities arranged by Art Trueblood and his entertainment committee. A picnic and watermelon bust was on the agenda, in addition to the planned recreation.

Through the donations and efforts of Frederick Preator of the National Education Committee, local gunsmiths, and Director Leslie Seager, the chapter acquired a custom-built big-game rifle as a prize in a special drawing, proceeds from which are to go to the chapter scholarship fund. The day ended western style, around a campfire.

—Don Easton

## Indianapolis Metals Night

Melvin D. Verson, vice president of marketing, Verson Allsteel Press Company, talked on the cold extrusion of metals, stressing the importance of proper dies and punches. He stated that dies and punches require the proper hardness and stresses and displayed several cold extruded parts as samples. Mr. Verson was assisted by R. W. Gardner of Cold and Impact Extrusions, who presented a movie on "Automated Cold Extrusions."

—R. E. Morris



**SCHUYLKILL VALLEY**—Chairman John Quinn, Jr., presents a token of appreciation to representatives of the Manufacturers Association, from left: William Carson, Judith Reitenauer, Deanna Rishel, and Albert Kendall. The occasion was Manufacturers Association Appreciation Night.



**SOUTHEAST MASSACHUSETTS**—At a recent technical meeting "Tracer Controls in Action" was the topic. Shown at dinner are, from left: Merrill Hunt, Jr., first vice chairman; Richard Norby and Joseph Sagat, speaker, both from the George Gorton Machine Company; and John Cieplik, chapter chairman.

## BOSTON

Many old-timers turned out for Boston chapter's past chairmen's night recently. Over 160 members and their guests were present for this meeting, where Clifford T. Appleton, vice president of Reed Rolled Thread Die Company in Holden, Massachusetts, discussed thread and form rolling. Mr. Appleton's informative talk outlined principles and developments of the thread-rolling process with its advantages and economies. Examples of preferred forms for rolling blank designs and specifications were shown.

## TRI-CITIES

"Work Simplification" was the title of the speech Charles A. Hanson, senior industrial engineer of the John Deere & Company of Moline, Illinois gave at Tri-Cities' September 11 chapter meeting.

Mr. Hanson introduced the "6-Step Pattern" in "Work Simplification" with a little magic and sleight-of-hand treatment. Illustrating his talk as he went along, Mr. Hanson outlined the steps: (1) pick a job to improve; (2) break it down in detail; (3) list possibilities; (4) work out a better method; (5) install new methods; (6) follow through.

## BINGHAMTON

Harry Conn of Scully-Jones & Company, also a member of the Chicago chapter, discussed optimum cutting speed or the minimum manufacturing cost cutting speed at Binghamton's recent meeting. He gave examples of quick-change tools which are preset outside the machine to take advantage of the optimum cutting speed and obtain increased production at the lowest manufacturing cost per unit.

Wendell Harper, who is a past chairman of the chapter, received his past chairman's pin at the meeting.

# members on the MOVE

**Robert O. Wilder**, formerly executive vice-president of National Forge & Ordnance Co., has now assumed duties of president, succeeding John C. Harrington. Mr. Wilder is a member of Chautauqua Warren chapter.

**John Monteau** is now manager of the Cri-Dan Div. of The Lees-Bradner Co. He previously was assistant manager of the division. Mr. Monteau is a member of ASTE's Cleveland chapter.

Giddings & Lewis Machine Tool Company announces the assignment of **Herbert A. Andresen**, district sales engineer of the Eastern District, as sales specialist for the Davis Boring Tool Division product lines.

Two appointments at The Fafnir Bearing Co. involved **Matthias P. Rival**, who was made chief plant engineer, and **Vladimir Mackas**, who became assistant chief plant engineer. Both men are members of ASTE's Hartford chapter.

**Edward J. McCabe**, chairman, Western Reserve chapter, recently became sales engineer for United Die & Manufacturing Company, Incorporated, in Lake Milton, Ohio.

**Fred Mondin**, Portland, Oregon, has been promoted to the position of general superintendent, Commercial Division, Bingham-Willamette Divisions, Willamette Iron and Steel Company.

**H. G. Thompson**, Cleveland, formerly with Murray Ohio Manufacturing Company as quality control manager, has accepted a position as chief inspector with John Oster Manufacturing Company in Milwaukee.

**Raymond Moorehead**, past chairman of Greater Lancaster, has been elected chairman of the Technical Societies Council, which is composed of 13 engineering groups of Lancaster, York and Harrisburg, Pennsylvania.

**Clinton J. Helton**, charter member of Denver, will head up the Helton Engineering Company as general manager. The company will offer engineering and development services to industry.

## CHICAGO

Chicago chapter tool engineers who attended the September 9 meeting, had a look into what the future will offer with regard to milling and machining operations. Arthur O. Fitzner, research engineer of the Giddings & Lewis Machine Tool Company, gave an interesting and informative talk on the "Numericord" system of machining.

Movies were shown of the machining of various parts of aircraft which was done automatically with all movements of heads and table guided by an automatic brain which, in turn, was guided by a prerecorded magnetic tape. Mr. Fitzner went through all operations, from the actual blueprints of the part to the necessary calculating and recording of the machine movements for the magnetic tape. This tape, when once made, could be used repeatedly and eliminates all hand or manual controls and templates. Once the machine is set up, it can mill parts to within 0.0005 accuracy and repeat the same piece constantly with no irregularities. The lecture and movie held everyone's interest. Mr. Fitzner remarked that the basic machine would probably cost one-half million dollars.

## CINCINNATI

The first meeting of Cincinnati chapter for the fall season was held September 10 at Engineering Headquarters. A total of 80 members and guests, after enjoying a fine dinner, retired to the main auditorium for the technical session. An excellent colored movie produced by the Creole Oil Company portrayed the work and social life of an American engineer in the Tidewater Oil Fields of Venezuela.

Chairman Moler Duff, Jr. called the meeting to order at 8 p.m. and Howard Peters, membership chairman, reported that the membership is now standing at the figure of 352, a net gain of 25 members over last year. Program Chairman Broadus Rusk revealed plans for the field trip to Champion Paper Company in Hamilton, Ohio. The speaker was then introduced, H. L. Nicholson of the Charles Bruning Company, Incorporated. Following a short talk, a film showing the use of optical tooling in the measurement and erection of parts and assemblies, too large to be measured with conventional means, was shown. A short question and answer period followed.

The meeting adjourned and members and guests retired to the dining hall for light refreshments and social hour.

## DETROIT

Members and guests of Detroit chapter Number 1 had an opportunity to meet with plant representatives of the Detroit area on their opening night of the 1957-58 sessions.

Fred J. Lutz, personnel manager, Engine Division of Chrysler Corporation, was guest speaker. His highly informative topic, "Development of Ideas," traced the formulation of thoughts to the final job of "Selling Your Ideas to Your Supervisor."

## HOUSTON

Over 175 members of the Houston chapter attended a plant tour of the WKM Division of American Car and Foundry. This new plant is one of the largest valve manufacturers in this country containing eleven acres of entirely air conditioned shops and offices.

## INDIANAPOLIS

Robert McKee, former National Education Committee chairman, of LeBlond Lathe Company, lectured on "High Level Turning Carbides and Ceramics" at the October 3 meeting. Thirty-five Purdue extension students and 80 members and guests were in attendance.

## LANSING

Richard A. Parsons, patent attorney, and examiner in the U. S. Patent Office from 1927 to 1937, delivered a lecture to 50 members at the Lansing Civic Center. He outlined the procedure and cost involved in applying for a patent.

## LEHIGH VALLEY

Edward Sulfridge, research engineer, Ultrasonic Division, Sheffield Corporation, spoke on ultrasonic machining of hard brittle material with the use of Cavitron methods at the September 20 meeting. Slides were shown. Coffee speaker of the evening was Professor Arthur Gould of Lehigh University.

## LIMA

Professor Carroll Alden of Ohio Northern University, Ada, Ohio, was the featured speaker at Lima chapter's September 19 meeting. The Ex-Cell-O Company showed a strip film of its progress. Coffee speaker of the evening was Hugh Jones, manager of manufacturing. He related the tool engineer's job to the technical growth of the nation.

## MISSISSIPPI

"Application of Coated Abrasives" was the topic James L. Rice of Behr Manning Co. discussed at the October 7 meeting at the Hotel Edwards.

## NORTHWESTERN PENNSYLVANIA

A movie on ultrasonic machining was the highlight of Northwestern Pennsylvania's October 3 meeting. Paul L. Schmidt, engineer of Raytheon Manufacturing Company, was speaker of the evening. Forty-six members attended the dinner and technical session.

## PATERSON

At the first meeting of the fall season, Fred Jessup, Project Service Division, Reaction Motors, Incorporated, presented a lecture on "Logic as It Applies to the Tool Engineer." Mr. Jessup has been in the process and tool engineering field for many years. Following the lecture, two films were shown: "Exploring Space" and "Rockets on Rotors"—each dealing with the fundamentals of rocket propulsion and rocket application.

At the conclusion of the film-showing, an open forum was conducted by Mr. Jessup and his associate, R. W. Ellison, senior project physicist of Reaction Motors, Incorporated.

## PEORIA

A plant tour of Barber-Colman was on the agenda for the chapter September 7. The morning tour was followed by lunch in the cafeteria and an afternoon tour of a new hob plant.

## SAGINAW VALLEY

Donald H. Hoagg, of General Motors Styling Section, discussed "Styling for Beauty, Engineering, Manufacturing" at Ladies Night on September 19.

## SCHUYLKILL VALLEY

Trouble shooting was the subject of a talk which was made by R. E. Balmat, contact metallurgist of Bethlehem Steel Company. Mr. Balmat pointed out the errors to be avoided in designing, grinding, and heat treating parts made of tool steel.

Chairman John H. Quinn, Jr. expressed appreciation to Judith Reitnauer and Deanna Rishel for excellent handling of chapter correspondence.

# In the national spotlight



**Harry Conrad, left, executive secretary, Editor Greve and President Collins discuss questions on automation in Europe for Mr. Collins' forthcoming television appearance, scheduled for the Semiannual Meeting in Milwaukee.**

"How widespread is automation in Europe today, and to what degree is it carried?" will be among the questions covered when President Harold E. Collins takes to the air waves in his television debut in Milwaukee, October 31. Having just returned from a tour of Ireland, England, and the continent, including a stop at the Hannover Trade Fair in Germany, Mr. Collins is in a good position to evaluate and compare automatic production as used abroad with that employed in this country. As manager of foreign operations of Hughes Tool Company, Houston, and director of Hughes Tool Company, Ltd., Belfast, he has a firsthand knowledge of manufacturing conditions and production trends in North Ireland and England, as well as in the United States.

Mr. Collins, in Milwaukee for the Semiannual Meeting, will appear on the TV show called "Mid-Day" originating in that city, which introduces viewers to prominent men in the news, or to those with important news stories to tell—particularly news of industrial significance. The live color program will be kinescoped for the benefit of those who will not see it at its original broadcast time, 11:30 a.m. till 12 noon, October 31.

Not only will Mr. Collins answer questions about automation and its acceptance abroad, but he will

also give his audience an insight into ASTE's activities, particularly regarding "Industry and Education Month," which will begin officially with Milwaukee chapter's opening program, November 1.

## Tool Engineer Editor Attends Trade Fair

Editor Jack Greve of THE TOOL ENGINEER has also returned from a tour of Europe where he visited manufacturing plants in various countries, as well as attended the Hannover Trade Fair, a European machine tool show, exhibiting production equipment from most of the major manufacturers abroad, as well as many in the United States.

In search of stories about European production techniques which might make interesting reading for tool engineers in America, Mr. Greve visited, among other plants, the ultramodern Schiess plant in Germany, which is equipped with the latest machinery, and a shotgun factory in Belgium, where ornamental engraving is done by the hands of skilled craftsmen, some hundred being employed in this art. Mr. Greve reports that one of the chief differences between American and European techniques is in the employment of craftsmen, specially trained in their art, who add that intangible human element, pride in their personal accomplishment.

# chapter news and views

## Diesel Plant Toured By London-St. Thomas

Prefacing the tour of the London plant of the General Motors Diesel Works by the London-St. Thomas District members, Howard King, works manager, extended a warm welcome to the visitors and discussed some of the techniques in tooling likely to be of interest to the group.

In addition to the massive welding fixtures, most uncommon in this area, and other mammoth tooling, a new technique stimulated the interest of the touring members—that of using steel rule dies for short-run steel and aluminum blanking. —*Ray Hind*

## San Fernando Program is On Magnesium Properties

A technical talk titled "A New Era in Tooling through Magnesium" and a color film on Vancouver Island, British Columbia, were the highlights of San Fernando Valley's most recent meeting. John R. Gibson, magnesium products manager of Reliance Magnesium Company, revealed the following facts about magnesium.

This metal, which is third most plentiful on the earth's surface, is two-thirds the weight of aluminum and less than one-fourth the weight of steel. This in itself is significant for use in jigs and fixtures, particularly if they are used by women. Magnesium can be machined four times faster than aluminum and ten times faster than steel. Since it is easily annealed and flattened, it is possible to obtain close-tolerance plates, free from residual stresses which normally warp the plate when cut. Thus rolled, magnesium is ideal for tooling purposes, having fine grain structure and freedom from porosity in the rolled and extruded forms. —*R. E. Ditrick*

## Windsor Breaks Two Membership Records



WINDSOR—Two records were broken at the most successful meeting of the chapter since its inception. The largest number ever to attend a technical meeting—256—and the largest number of new members received into the chapter—57—were the record-breaking events of this chapter, which now has more than 350 members. Shown are a few of the new members receiving their certificates from W. N. Moore, chairman. At the extreme left is B. Farron, membership chairman.

—*J. H. Kirkwood*

Technical speaker at a recent record-breaking meeting of Windsor chapter was Theodore J. Emmert, executive vice president of the Ford Motor Company of Canada, Limited. Mr. Emmert addressed the 256 people, the largest number ever to attend the meeting, on "Tooling up for Sales." Mr. Emmert's address was preceded by the Canadian premiere showing of a film, "The Stylist." At the same meeting 57 new members, also a record number, received their certificates of membership.

In his address, Mr. Emmert defined the tool engineer as being the man who takes the dreams of stylists and fashions them into reality. A good tool engineer, he continued, must have a sound foundation, which should include

a combination of imagination and ingenuity, insatiable curiosity, a hunger for facts, a memory like an elephant and at least the fundamentals of salesmanship.

The speaker went on to describe the best engineers in this highly competitive industry as "sales minded." Realizing that companies tool up to sell things, not merely to make things, the tool engineer must tool a plant with adequate capacity for efficient production at the lowest possible capital cost and ensure that the equipment will provide goods of an equal or higher quality than the competition. The entire future of any company, he stated, can rest on the competence of the tooling job done by its tool engineers.

## Industrial Waxes Topic at San Antonio

Members of the San Antonio chapter heard Tom Woodard of The S. C. Johnson & Sons speak on industrial waxes at a recent technical meeting. The talk was followed by a clever combination of two interesting color films, "Research in the Field of Metal Turning" by Jones and Lamson and "Metalworking with Wax" produced by S. C. Johnson and Sons. Slow motion and high magnification in the first picture showed why longer tool life, better finish and less grain distortion are made possible by higher cutting speeds. The second picture pointed out the desired qualities of metalworking coolants.

—Richard F. Boothe

## Two Students Receive Santa Ana Scholarship

As a part of Santa Ana Valley chapter's continuing campaign to alleviate the critical shortage of graduate engineers, members sponsored a design engineering contest for students of Orange County junior colleges. Winners were Clifford Bonner of Fullerton Junior College and Emil Dopyera of Orange Coast College, each of whom received a \$100 scholarship to continue his engineering studies at any college or university of his choice. The money will be deposited with the registrar of his chosen school upon certification of his registration there, insuring that the money will be used for the intended purpose.

—M. E. Hulett

## The Ampex Story is Told at Santa Clara



SANTA CLARA VALLEY—Chairman L. H. Cook and Vincent Diehl, left, pose with technical speakers, Arthur Kromer and John G. Johnson of the Ampex Corporation. The men gave descriptive talks on operations at their company.

Two representatives of the Ampex Corporation acted as technical speakers at a recent Santa Clara Valley chapter meeting. Arthur P. Kromer, chief manufacturing engineer, and John G. Johnson, chief tool engineer, described some of the assemblies produced by Ampex and told how specific tooling problems had been solved.

Mr. Kromer explained that the manufacturing department at Ampex is frequently required to tool up for a product which has very little lead-time between engineering release and the completion of the first models. Therefore, he said, it is frequently necessary to improvise tooling to meet the deadline.

Mr. Johnson talked about specific tooling problems faced by Ampex. He described a method of constructing inexpensive dies to punch out chassis, and a method of tooling up for punching chassis in very limited numbers. This was done by laying out a sheet of metal template and using this template in conjunction with a small punch equipped with a stylus attachment. The work was positioned in the punch by locating the stylus on the hole locations on the template.

Following the technical meeting, ten new members of Santa Clara Valley chapter received their membership pins.

—Dresden Smith

## Rockford Celebrates Twentieth Anniversary With Outing



Featured speaker of a special meeting commemorating Rockford's twentieth anniversary as a chapter was Harry Conrad, executive secretary of ASTE. The occasion was celebrated with an outing at Svitold Park. "The Good Old Days" was the subject of a speech by Ed Dickett, charter chairman in 1937, while Mr. Conrad's talk was titled "Better New Days of ASTE."

A special guest at this affair was the Rev. Mr. Harold Carlson, who gave the invocation both in 1937 and at this meeting.

—Kenneth R. Bookland

ROCKFORD—Shown from left are: Chairman Fraser, Ed Dickett, charter chairman, George Johnson and Herb Olson, both members of the original charter year executive committee.

# Chapter News and Views



LOS ANGELES—A panel discussion on "Why Plastics in Tooling?" had as its speakers, H. E. Rumenapp of Douglas Aircraft Company; Lloyd J. Oye, Rezinol, Incorporated; Norry Mark Hasting, president, Hasting's Plastics Incorporated; A. M. Guerreiro, Northrup Aircraft; and Russell Lamb, program chairman. Subjects discussed were vacuum bag method of laminating plastic tools, heated form dies incorporating integrally bonded electric heaters, and uses of the various material available for tooling.

—Gene Grahn



ST. LOUIS—A tour of Century Foundry afforded members an excellent opportunity to see a foundry equipped to handle production and semiproduction work of coremaking, molding, and a new type of shell molding and ductile iron molding.

—William A. Russell



GRAND RAPIDS—Following his talk, Vice President H. Dale Long, left, is pictured with members and guests at the Fourth Annual Ladies Night. The Rev. Eugene Slep was speaker of the evening.

—Philip Van Dommelen

## Retirement Plan Announced at Tri-Cities Meeting

Dan J. McKeon, Tri-Cities chapter chairman, announced the adoption of the "Tri-Cities Chapter Retirement Plan" at the chapter's most recent meeting, held at the Rock Island Arsenal. The new plan provides full payment of the cost of membership for any member meeting the following requirements: (1) ten years of ASTE membership with at least five years in the Tri-Cities chapter; (2) attainment of age 65 years or more; (3) retirement from the company for which he worked at the time of reaching age 65; (4) residence in the area of Tri-Cities' active membership; (5) attendance at three meetings a year, excusable for health reasons; (6) condition of a charter member's retaining membership in Tri-Cities chapter until reaching age 65; (7) this paid membership to be extended to charter members and retired members upon their application each year.

Chairman McKeon stated that the "Retirement Plan" is just one of many new programs to be instituted during the 1957-58 meeting season, by its officers and committees. —D. B. Cardinal

## Tucson Members Learn City's Industrial Future

The theme of Tucson's recent monthly meeting was "The Industrial Future of Tucson." Speaker of the evening was C. T. Kenney, Director of Industrial Development of Pima County and the Tucson Chamber of Commerce. Mr. Kenney pointed out important aspects in the "tooling trek toward Tucson." He reminded his audience that Arizona, the baby state, long known as a health climate and for its exports of copper, cattle and cotton, is commonly referred to as "The Electronics Center" of the United States.

As many people are currently engaged in manufacturing in Tucson as were engaged in the entire state of Arizona ten years ago, Mr. Kenney disclosed. He cited astonishing industrial growth, which has resulted in Arizona's advance in manufacturing. History relates that ASTE's Tucson chapter was organized when this manufacturing development was first apparent and has remained active through the years of progress. Chapter membership is composed of representatives of practically all industrial concerns playing a part in this industrial expansion.

—Harvey K. Hersey

## Worcester Visits Abrasive Manufacturer

"Solving the Grinding Wheel Mystery" was a 'down-to-earth' discussion on the selection of grinding wheels, the technical topic for Worcester's recent meeting. Presented by Robert I. Belmont, New England district sales manager for Bay State Abrasive Company, the talk included a thorough explanation of the specifications symbols printed on each grinding wheel. This cleared up for many of the members the mystery these symbols present at times.

Preceding the evening meeting, a plant tour of the Bay State Company was made by 45 members. Visiting tool engineers observed the complete cycle which the abrasive takes in the process of becoming a grinding tool.

—Robert A. Cusson



DETROIT—Over 65 members were honored at Detroit chapter's kickoff dinner meeting held at the Rackam Building, plant representative night. From left are: J. Gambino, plant representative chairman; J. Anderson, Jr., program chairman; Fred J. Lutz, personnel manager of Chrysler Corporation, who was the guest speaker; Tony Rogers, first vice chairman; and Ed Novack, chapter chairman. —Joseph F. Wrobel

## Vertical Grinding Topic At Springfield, Ohio

Eighty people attended Springfield, Ohio's recent dinner meeting and tooling seminar held at Springfield Machine Tool Company. Richard C. Montanus, vice president and chief engineer of the company, spoke on "The Vertical Principle of Grinding and Its Advantages." Mr. Montanus is responsible for the design of his company's vertical universal grinder, which has been highly accepted throughout the country, as well as abroad.

Also attending the seminar was Philip Harvey, assistant technical director from ASTE's headquarters, Detroit.

—Kenneth W. Keller

## Portland, Ore. Hears Power Tooling Talks

Guest speaker Richard J. Horrocks, branch manager of Thor Power Tool Company, and Robert Burns, Portland member and service engineer for the company, both covered the subject of power tooling with talks and the presentation of a film at the first fall meeting of Portland, Oregon.

In addition to these speakers, Professor Milton C. Sheely, chapter chairman, told members of his experience during the past summer at the Boeing Aircraft plant in Seattle, during the setting up of operations and schooling of personnel to operate the entire system of numerical tape control now being adopted by Boeing.

Also at the meeting Russell Williamson reported on the progress made toward organizing a student chapter.

—Walter Brenneke



MUSKEGON—A special ladies night meeting featured J. B. Hayes, center, professor emeritus of Michigan State University, who disclosed his theories on "Capital Bovine Architecture," giving a very humorous dissertation on cows. Mr. Hayes uses lecture proceeds for scholarships at Michigan State. Shown with him are, left: J. Retsema, vice chairman; and Willard Biersma, chairman. —Donald G. Fredrickson



MID-HUDSON—Members and guests were welcomed to IBM by W. J. Mair, vice president, prior to a tour of that company's electronic data processing division. The tour was highlighted by a talk on "A Practical Look at Electronic Data Program Processing" by J. W. Rooney of IBM's staff. The equipment was seen in the processes of being built and tested. —Attila deilly

# Coming Meetings



1958 ASTE Tool Show  
26th Annual Meeting  
May 1-8  
Philadelphia Convention Center

## National

SEMIANNUAL MEETING—Oct. 31 and Nov. 1, Milwaukee. Included in week-end program—Milwaukee chapter's Kickoff Industry and Education Night, Nov. 1, designating the start of Industry and Education Month.

## Conference

BRADLEY UNIVERSITY—Nov. 2, Peoria, Illinois chapters' Annual Tool Engineering Conference.

## Chapter

BALTIMORE—Nov. 6, 8 p.m., Engineers Club, "Tape-Operated Turret Lathes and Drill Presses" by D. N. Smith, sales manager, Jones & Lamson. Movies illustrating the equipment.

BOSTON—Nov. 14, Industry and Education Night, "New Machining Concept" by Harry Conn, Scully-Jones.

CENTRAL PENNSYLVANIA—Nov. 6, Stag Night. Election of Nominating Committee.

CHAUTAUQUA-WARREN—Nov. 21, 7 p.m., Warren, Pa. "Application of Electronics for Automation" by Mr. Davidson, chief engineer and president, Davidson Electronics Corp.

CINCINNATI—Nov. 12, 7:30 p.m., Engineering Society Headquarters, "Ceramic Tooling" by Norman Zlatin, Registered Professional Engineer, Metcut Research Associates. Dinner and Movies.

DAYTON—Nov. 18, 6:30 p.m., Suttmiller's Restaurant, "For Positive Hold-Down in Drawing Dies" by C. H. Barrett, president, Die-Draulic Grip, Inc. Slides accompany talk.

DENVER—Nov. 14, 6:45 p.m., American Legion Post, No. 1, "Graphitic Steels and Their Applications" by Paul J. Garmus, field engineer, Graphitic Steel Div., Timken Roller Bearing.

DES MOINES—Nov. 13, 7 p.m., Des Moines Country Club, "Tooling for Induction Heating" by a representative of the Ohio Crankshaft Co.

ERIE—Nov. 6, 6:30 p.m., East Erie Turners, Industry and Education Night. Speakers, Edmund Hollingsworth, director, ASTE; and Dr. John M. Hickey, superintendent of Erie schools.

EVANSVILLE—Nov. 11, 6:30 p.m., Hadi Shrine Temple, "Production Tooling Problems" by Harry Conn of Scully-Jones & Co.

FAIRFIELD—Nov. 6, 7 p.m., place to be announced, "Crystall-Balling the Human Effect of Automation" by Robert H. Guest, M.A., associate director of Research, Yale University Technology Project.

GREATER NEW YORK—Nov. 13, social hour, 6; dinner, 7; meeting, 8 p.m., Hotel Belmont Plaza. Joint meeting with the Tool and Die Institute of New York, "Tool and Die Progress in Europe" by Frank H. Wikstrom, past president of the Tool and Die Institute and president, Frank G. Wikstrom & Sons, Inc.

HARTFORD—Nov. 4, 6 p.m., The Hedges, New Britain, Conn. "Shell Molding," speaker to be announced.

HOUSTON—Nov. 12, 6:30 p.m., Ben Milam Hotel, "Engineering—The Tools of Democracy" by Allan Shivers, former governor of Texas. Annual Executives' Night.

INDIANAPOLIS—Nov. 7, 8 p.m., 40 and 8 Chateau, 619 North Pennsylvania St. Executives' Night.

JACKSON—Nov. 18, 7 p.m., Arbor Hills Country Club, "Manufacture of Aluminum and Its Fabrication in Relation to Die Design" by Hugh D. McKinnon, executive vice president and general manager, Sheet Aluminum Corp., Div. of Mueller Brass.

KALAMAZOO—Nov. 21, 8 p.m., Y.M.C.A., "Thread and Form Rolling" by Clifford T. Appleton, vice president, Reed Rolled Thread and Die Co.

KEystone—Nov. 18, 7 p.m., Castle Restaurant, "The New Machining Concept—Optimization" with slides by Harry Conn, chief engineer, Scully-Jones & Co.

KOKOMO—Nov. 14, 6:30, American Legion Home, Movies of summer picnic and "Engineering Education Today" by Dr. A. R. Spaulding, Dean of Freshmen Engineering Dept., Purdue University.

LANSING—Nov. 11, 7:30, Lansing Civic Center, Rooms C & D, "The Technical Consultant's Place in the Metal Stamping Industry" with slides and case histories by Stanley Cope, founder and president of Acme International School of Tool and Die Design Engineering.

LEHIGH VALLEY—Nov. 12, dinner, 6:30, meeting, 8 p.m., Hotel Berkshire, Reading, Joint meeting with Schuylkill Valley, "Machines, Fixtures and Engineers Abroad" by H. E. Collins, ASTE national president.

LIMA—Nov. 21, 6:30 p.m., Clemans Building. "The Standardization and Unification of Screw Threads" by Henry Bender, section manager, Engineering Services, Westinghouse Aircraft Div.

LITTLE RHODY—Nov. 14, 6:45 p.m., Metals and Controls, Attleboro, Mass. Plant tour and buffet.

LONDON-ST. THOMAS & DISTRICT—Nov. 22, 8 p.m., Morrow Screw & Nut Co., Ltd. plant tour.

LONG BEACH—Nov. 13, 7 p.m., The Petroleum Club. "The Tool Engineer's Role in Industry" by industrial leaders from Southern California.

LOS ANGELES—Nov. 14, 7 p.m., Scully's Restaurant. Father and Son Education Night panel includes, among others, Wayne Ewing, national vice president, ASTE; Francis Whiting, faculty adviser, California Polytechnical; and Harold Camp, apprentice consultant, State of California.

MACOMB—Nov. 7, evening, plant tour of Ford Sterling plant, Mound Road at Seventeen Mile.

MANSFIELD—Nov. 21, 7 p.m., Fairway Club, dinner. "The Five Echelons of Accuracy" by B. D. Witemeyer, general manager of Fixed Gage and Inspection, Sheffield Corp.

MISSISSIPPI—Nov. 4, 7 p.m., Vicksburg. Offshore oil rig, plant tour. R. G. LeTourneau.

MONADNOCK—Nov. 21, 7:15 p.m., Kingsbury Machine Tool Corp. cafeteria. "Wax as a Lubricant for Metalworking" by Arthur Langlois, sales engineer, Johnson Wax Co.

NEBRASKA—Nov. 21, 6:30 p.m., Lincoln. "Ceramic Tooling" by Mr. Hoon, chief metallurgist, Warner & Swasey.

OZARK—Nov. 21, 7:30 p.m., Vickers, Inc., Joplin. Plant tour.

PEORIA—Nov. 21, 6:30 p.m., Timberlake Country Club. Business meeting; election of nominating committee.

PHILADELPHIA—Nov. 21, 7:45 p.m., Engineers Club of Philadelphia. Father and Son Night. "Sport Celebrities."

PIEDMONT—Nov. 11, social hour, 6; dinner 6:30; and technical session, 7:30 p.m., Charlotte, N. C. "Atomic Energy in Your Future" by David Nabow, chief engineer, Duke Power Co. Executives' Night.

ROCHESTER—Nov. 4, 8 p.m., Barnard's Exempt Club. "Optical Gaging and Its Uses in Industry" by W. J. Stolp, Special Products Sales Div., Eastman Kodak Co.

ROCKFORD—Nov. 14, 6:30 p.m., Lafayette Hotel. "Gages—Watch Dogs and Bandits" by Glen Stinson, manager of sales and chief engineer, Greenfield Tap & Die Co.

SAGINAW VALLEY—Nov. 7, 7 p.m., General Motors Institute. "Ceramic Cutting Tools" by Robert T. Hook, chief metallurgist, Warner & Swasey Co. Demonstrations before dinner.

SAN DIEGO—Nov. 18-21, 7 p.m., Convair Plant No. 2, San Diego. Education program with high school and college students, members and guests invited to participate in plant tours.

SAN FERNANDO VALLEY—Nov. 2, 7 p.m., Hody's Restaurant. "Building and Flying of the Lockheed Missile X17" by C. W. Harris, director of Lockheed Van Nuys Research and Development.

SANTA CLARA VALLEY—Nov. 19, 8 p.m., place to be announced. "Evolution of the Lathe" by Jerry Burke.

SCHUYLKILL VALLEY—Nov. 12, 8 p.m., Berkshire Hotel Ballroom. Combined meeting with Lehigh Valley chapter. "Machines, Fixtures and Tool Engineers Abroad" by Harold E. Collins, ASTE national president. Coffee speaker, Edward Wheeler.

SOUTHEAST KANSAS—Nov. 14, plant tour Vickers, Inc., Joplin, Mo.

SYDNEY, AUSTRALIA—Nov. 13, 7:30 p.m. in the A.I.B. Lecture Hall, Milsons Point. Mr. Heyde of Unilever Australia Pty., Ltd., will give a lecture on "Time Saving." Refreshments.

TRI-CITIES—Nov. 13, 6:30 p.m., Moline Legion Club Rooms. "Use of a Tracer Guided Cutting Tool to Supplement Multiple Tools in Production Turning" by Willis H. Kuhlmann, technical engineer, Monarch Machine Tool Co. Outlining of detailed program on "Junior Achievement" activities in Tri-Cities Area.

TUCSON—Nov. 12, 7:30 p.m., Tucson Inn. "Graphic Tool Steels and Their Applications" by Paul J. Garmus, Timken Roller Bearing Co. Guest Night.

TWIN CITIES—Nov. 6, 5:30 p.m., Robinhood Room, Dykman Hotel. "Inclinable Press Maintenance and Transfer Feed Presses in the Appliance Industry" with sound color movies, by W. S. Wagner, development engineer, E. W. Bliss Co.

TWIN STATES—Nov. 13, 7 p.m., Adna Brown Hotel, Springfield, Vt. "Plastic Tooling Components" by R. D. Sedgwick, Airex Corp.

WINDSOR—Nov. 11, 7:30 p.m., Prince Edward Hotel. "Air Gaging" by Ed Hockenson, general manager of Machine Mfg. Div., Sheffield Corp.

WORCESTER—Nov. 12, 6:30 p.m., Putnam & Thurston Restaurant. "Design and Manufacture of Better and Cheaper Mousetraps" by Harry Dixon, Metallurgical Products Co.

## Positions Available

**MANUFACTURER'S REPRESENTATIVES**—Progressive gage company specializing in large diameter, dial snap, bore, pin, and plug and ring gages. Factory assistance, prompt service and engineering and design aids available. For further information send complete details of background to WJZ Tool Specialties, East Park Road, Hyde Park, New York.

**PROJECT ENGINEER**—Excellent opportunity for M. E. experienced in planning and estimating cost of parts and tooling. Familiarity with design and operation of progressive dies. San Francisco manufacturer, steady employment, progressive and expanding company, international distribution, modern plant and equipment. Excellent company benefits. Please state age, education and minimum salary requirements in first letter. Include detailed resume of experience. Schlage Lock Company, P. O. Box 3324, San Francisco, Calif.

**TOOL DESIGNER**—Experienced in designing jigs, fixtures, gages, rotary indexing fixtures, and automated assembly fixtures for high-volume production. Due to this high production requirement, the designer must be able to design class "A" tools. San Francisco manufacturer, steady employment, progressive and expanding company, international distribution, modern plant and equipment. Excellent company benefits. Please state age, education and minimum salary requirements in first letter. Include detailed resume of experience. Schlage Lock Company, P. O. Box 3324, San Francisco, Calif.

## Obituaries

**John Carl Maul**, Mansfield, Secretary-Treasurer, Case-Maul Manufacturing Company

**Edgar V. Nordstrom**, Chicago, plant superintendent, W. A. Kates Company.

**Norman G. Rinden**, Madison, salesman, Gordon Engineers, Inc.

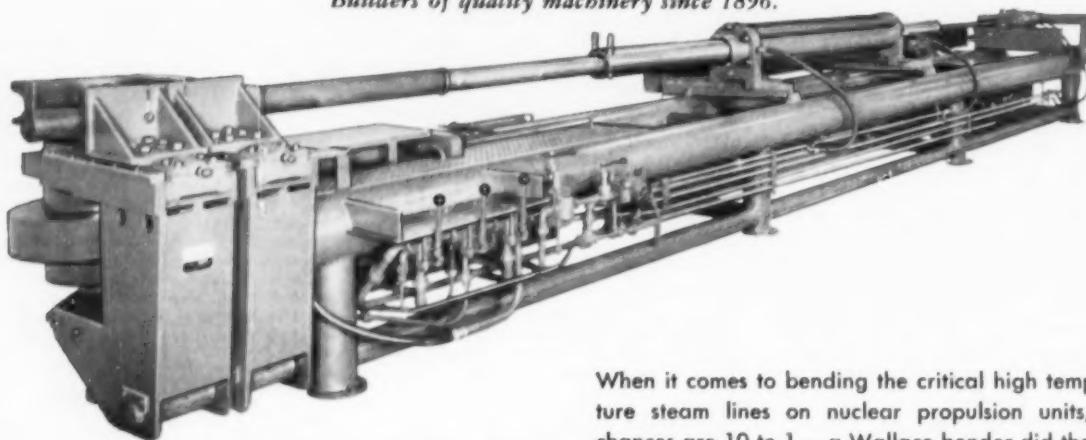
**Herbert W. Wenzlaff**, Santa Ana Valley, tool designer and manager, LaSalle Tool and Engineering Company.

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# PROGRESS IN PRODUCTION

## METAL FLIES THROUGH HIGH-SPEED PRESS

Semifabricated metal sheets are being produced on an unusual "Flying press" at twice to three times the speed possible on conventional equipment. The press is part of a \$330,000 high-speed coil processing line just completed in October at the Hallowell Div. of Standard Pressed Steel Co. to streamline and expand its facilities.

As raw material the equipment uses coils of steel 48 inches wide, weighing

up to 30,000 lb—twice the size of coils normally supplied for such operation. Use of the outside coils is expected to result in major economies in inventory, scrap and handling.

The Flying Press, so-called because its rotary die motion permits fabrication of steel while the metal is on the fly, can shear, blank, pierce and detail steel shelves up to 48 by 48 by 36 inches with one sliding stroke. Skip sequencing of the die stroke permits the press to turn out sheet sizes in any length up to the limits of the enclosing building. Feeding from the coil through the press is continuous at speeds up to 300 fpm; consequently the unit reaches very high production rates.

Other equipment in the 210-ft line, all produced by Wean Equipment Co. of Cleveland, includes a high-speed, high capacity slitter for reducing wide coils down to smaller sizes needed for specific components, and an edge conditioner for conditioning smaller coils, up to  $7\frac{1}{2}$  inches wide, for subsequent press operations. A scrap baller takes care of waste trimmings from the slitting line.

Several major benefits are expected to result from the line. Hertofore, SPS has purchased sheet steel in various sizes and then trimmed it to required sizes for production. Now the huge

**First element in flexible, high-speed pressed steel production, the giant Flying Press slices steel to size from 15-ton coil. (Photo at left)**

coils are slit and sheared at high speed to most practical sizes and dimensions; and blank size and inventories, handling and storage problems are simplified. Units of the line can be operated singly or in sequence. The Flying Press itself operates at up to 200 strokes a minute for 18-inch feed lengths, with work done on the fly while dies and strip are both in continuous motion. It has no flywheel, clutch or brake.

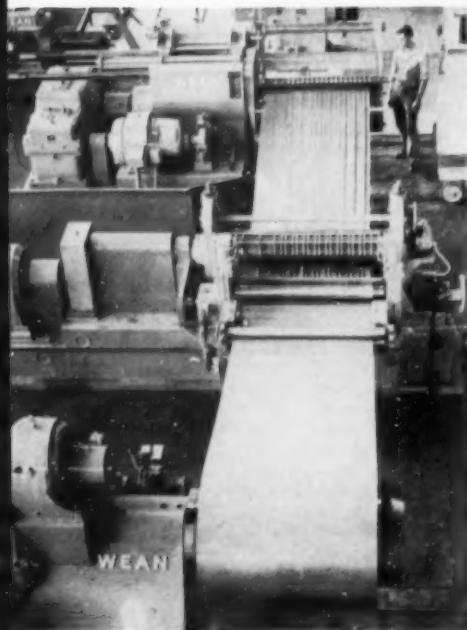
## INSTRUMENTATION

### AUTOMATES POWER PLANT

Fully automatic control of an entire plant will materialize with an installation at the new 200,000-kw unit at Sterlington Steam Electric Station of Louisiana Power and Light Co. The system is being installed by Systems Div. of the newly organized Controlonics Group of Daystrom, Inc. It will cover measurements at 350 points throughout the power plant. Of the total, 100 points will be automatically logged every hour while the rest are continuously scanned and read out on a separate printer if they exceed set limits. An automatic alarm system also is provided. The operator can at any time select any or all 350 points for readings. Thus, all significant information on the plant's operation will be presented at a central point.

The installation offers exceptional accuracy and reliability. Transistors are used rather than vacuum tubes; relays are all of mercury wetted computer type, etc. so that all electronics are solid state, thus avoiding sudden failure in the system.

Programming is accomplished by punching paper tape for all instructions; the information is stored magnetically in the computer and can be varied easily without physical changes in the equipment.



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INDICATE A-11-152

## RESEARCH PRODUCES MILLING SUGGESTIONS FOR TITANIUM INDUSTRY

Although the controversy of whether to use high-speed steel, cast alloy or carbide to mill titanium alloys continues, research engineers at the Martin Co. are making important strides toward overcoming many present problems.

In work with existing milling difficulties, considerable information has been accumulated and is reported by A. L. Winkler, senior manufacturing engineer of manufacturing research and development.

In the initial study, several machining operations, such as facing, profiling and slotting, were performed on a quantity of titanium forgings 36 inches long. Various combinations of carbide grades, rake angles, feeds and speeds were used to perform facing operations. Results, however, were considered unsatisfactory since welding of chips to the cutting edges could not be overcome and since tool life was extremely short.

Facing operation was finally completed with high-speed steel face mills operating at a speed of 40 to 50 fpm and a feed of 0.750 ipm. Production, however, was low and cutter regrinding was necessary after several passes. Part warpage moreover was often in excess of 1/16 inch.

On a second lot of parts, carbide slab mills were used for the facing operation. Cutters, which were of grade C-2 carbide and 30 and 45-deg helix angles (originally designed for cutting aluminum), were mounted on a No. 3 horizontal mill with two arbor supports. Conventional cutting was required to assure limited contact between tooth face and forging scale.

Best results were realized at 120 fpm and at a 3-ipm feed with a liberal flow of sulphur base oil. The helical spiral of the cutting teeth caused the chips to slide along the cutting edges at a sufficient rate to prevent the chips from welding to the cutting edges. The rms finishes were excellent; part warpage

was negligible. The 30 and 45-deg. spiral blades cut equally well, although the latter produced the better finishes. Tool life was excellent and, in some cases, cutters were used for two eight-hour shifts before regrinding was required.

Parts were then faced to size by climb cutting with slab mill cutters. During this operation the slot, which had been previously milled, was observed to be closing, and support necessarily had to be given it before proceeding.

To prevent grab and breakage, cutters were fed gradually into the cut. Plunge cutting with carbide was avoided, as it was determined to be a contributing factor in tool breakage.

No apparent difference was noted between effects of two types of coolant on carbide end mills when a force flow of sulphur base oil was used on one machine, while a water-soluble oil, applied in a spray mist form, was used on another machine. In the free flow application, however, chips seemed to collect while pressure of the spray mist carried chips away from the cutter.

In this manner of try, observe, improve and try again, the experiments continued until the researchers felt they had accumulated enough information for at least a tentative check list.

A summary of conclusions gained by the researchers might serve as a recommended list for successful milling of titanium alloys:

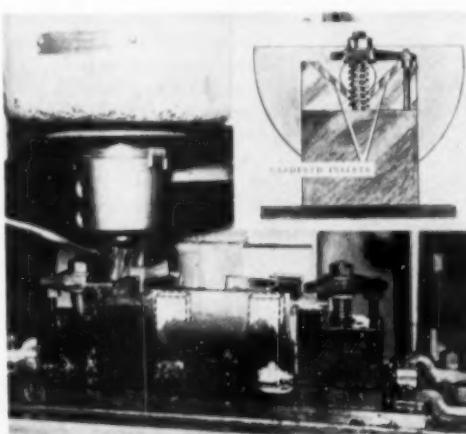
Avoid butt mill applications (high-speed steel or carbide)

Use helical carbide slab mills (45 deg recommended)

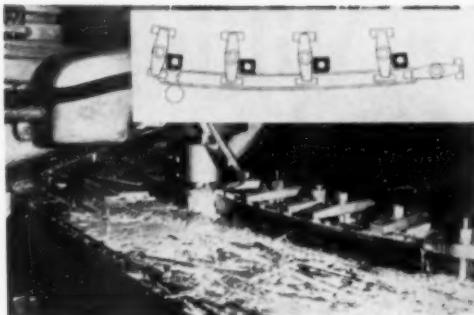
For carbide end and slab mill operations, 80 to 120 fpm is recommended, and chip loads should be 0.005 to 0.015.

Apply coolant liberally, using sulphur base oil flow or spray mist coolants.

Insure removal of chips to prevent carry-through on successive cuts



Two original side clamps (in outline) and four side clamps inserted to provide added strength to the titanium part, are shown arranged for the milling operation. Hardened steel inserts were provided to prevent the part from embedding in the vee.



During profile milling of the titanium part, initial cuts were made with high-speed end mills. Lack of rigidity in the setup caused parts to flex and move to and from the cutter. Inset shows top view of the back-up blocks which were spaced 8 in. apart to minimize this flexibility.

Check closely on cutting tool wear, removing dull tools immediately

Use a conventional cut when scale is removed

Avoid plunge cuts with carbide end mills  
Add hardened plates to fixtures when the part contact area is small

Add backup blocks to support the part when the cross-sectional area is small in relation to its length

Use clamps at frequent intervals, clamping as close to the machining area as possible

Design all fixtures for maximum rigidity  
Cut in the direction of maximum support

If cast alloy cutters are used, they should be operated at 80 to 100 fpm with a 0.002 minimum chip load. The chips should be removed with a mounted wire brush

High-speed steel cutters should be operated at 30 to 50 fpm with a 0.002 to 0.005 chip load

Shim slots for support when making outside cuts

Support the sides of the parts to avoid expansion when slots are being machined

Use of carbide slotting cutters should be avoided pending further development

Use double arbor supports and flywheels placed as close to the workpiece as possible

Use double keyways in slotting cutters

Do not use stub arbors for arbor type slotting and facing cutters

Do not stop milling cutters while they are engaged in a cut

Carbide end mills should not be used for profiling when the length of contact between the part and the side of the end mill exceeds two thirds of the end mill diameter

During drilling operations, the drills must be backed out at frequent intervals to prevent the jamming of chips.

## THREAD INSERTS CUT DIE HOLDER MAINTENANCE

Die holder maintenance can be particularly costly on short press runs when die changes are frequent. Such a situation existed at Forging and Screw Machine Div. of Scovill Mfg. Co. where hot forging operations are performed.

In this case, frequent failure on the die holders was because of the damaged threads in the tapped holes used to locate and hold down dies. Vibration of the large presses shook loose the hold down bolts, and the resultant thread wear allowed dies to move out of alignment. In unused holes, scale from billets prevented tightening of bolts on larger dies. In some instances, an operator would place a cold billet in the die when starting the new die run; as a result, the two die halves stuck together. The bolts normally pulled out of the holders and stripped the threads.

Each time a thread was stripped or worn, the die holder had to be returned to the machine shop to be filled with weld, drilled and retapped to the size of the standard  $\frac{3}{4}$ -in. bolts used as standard components. Unless another die holder was available, four hours press shutdown was unavoidable.

As a solution, Heli-Coil wire thread inserts are now fitted in all of the threaded holes. Threads in the insert lined holes can safely withstand 20 to 30 percent higher loads than an unprotected tapped hole because of better load distribution, and the threads are virtually free from vibration or assembly wear.

While under the former operation, die holders normally lasted four weeks, they now last seven months; and press downtime is negligible with the vibration resistant threaded assembly.

**Tapped holes in this two step die holder are protected with spring like inserts which provide thread engagement of 90 percent or better.**



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INDICATE A-11-153

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<b>VR-75</b>	A tough heat-resistant general purpose steel cutting grade. Especially recommended for severe applications where high heat is generated.



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**CARBIDE TIPS FOR BLADES**



**SOLID HELICAL BLADES AND SPECIALS**



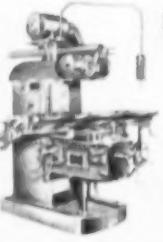
**THROW-AWAY INSERTS FOR MILLING CUTTERS**

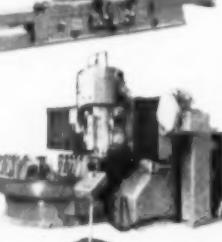












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## Vertical Four Slide Machine

All-purpose vertical four slide machine provides maximum visibility and accessibility to all parts of the machine, particularly the tooling area, and requires minimum floor space. Operations of this Verti-Slide can be conveniently accomplished by the setup man while standing upright in front of the machine. Adjustment of the feed stroke, cams, presses and cutoff are made at the same position.

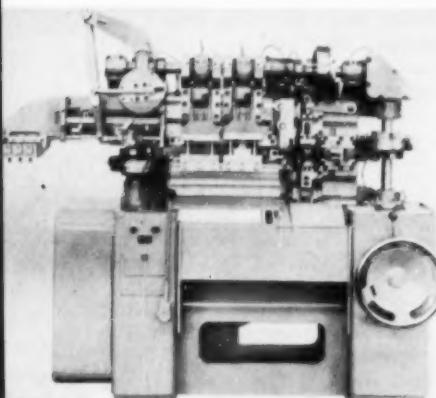
Parts are ejected from the front of

automatic centralized lubrication system. All important bearings are connected through nylon tubes to an air-operated pump. Depending on the bearing size, from 0.003 to 0.009 cu in. of grease is forced onto the bearing surfaces through metering valves at predetermined intervals. Proper functioning of the system is monitored by a pressure switch.

The unit's clutch is located between the flywheel and cam shaft system and the flywheel rotates continuously providing energy for jogging. Because the flywheel can be instantly disconnected, the machine can be stopped quickly. The handwheel is automatically separated from the main drive when the clutch is engaged. Slides and slide bases are separate assemblies which can be removed from the bed. The optional positive stock clamp attached to the front slide is independent of the top slide's travel, permitting use of the stock clamp for other purposes. Cams are split type and are adjustable through 360 deg. Insert type cams will also be available.

The Torrington Mfg. Co., Torrington, Conn.

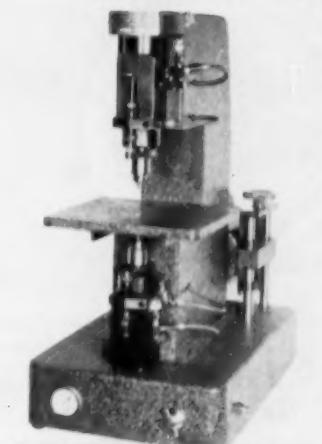
T-11-1



the machine. Conveying and handling for secondary operations are easily mechanized.

Center form of the Verti-Slide is mounted in the bed, providing both a strong and rigid mounting. An extra large mounting plate enables large tools to be fastened securely and economically.

The machine is provided with an au-



double-acting cylinders, and is foot controlled leaving both hands free to handle work.

Model Machine Co., Inc., 4729 Hawthorne St., Philadelphia 24, Pa.

T-11-2

## Automatic Feeder-Driver

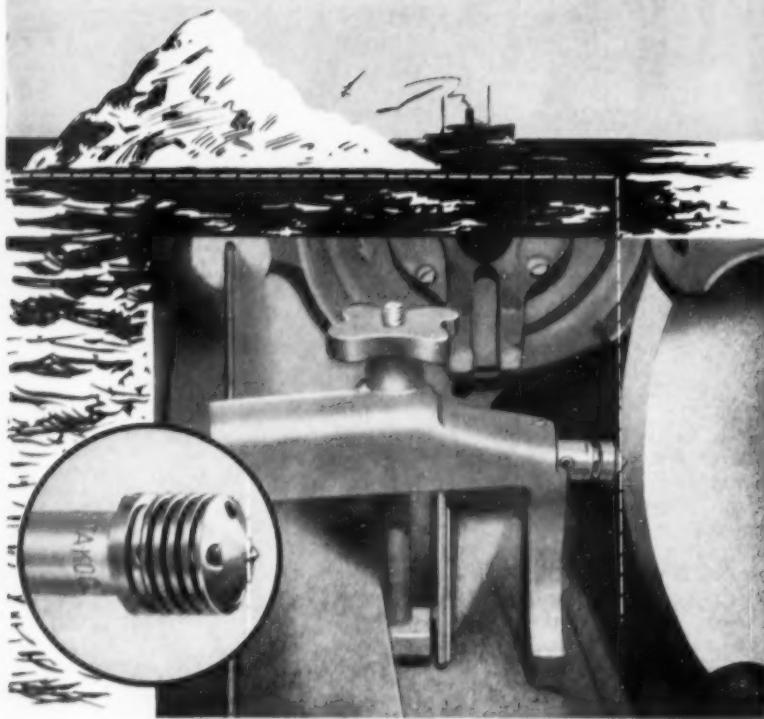
Both sides of holes in flat and thin sections can be deburred with the alternating spindles on this vertical deburring machine. After top spindle has finished deburring one side, it retracts and bottom spindle then deburrs other side. On thicker sections a switch is provided to bring both spindles together at the same time. Holes  $\frac{1}{32}$  to  $\frac{1}{2}$  in. diam can now be deburred in less than half the time of previous deburring methods.

The machine is air operated through

Standard socket set screws can be automatically fed and driven at rates up to 1800 per hour by this production equipment. It will handle standard, unmodified socket set screws in either hex or multiple spline socket types, and with any of the standard points. Screws in diameters down to No. 2 wire size and up to  $\frac{5}{8}$  in. diam can be driven, with lengths down to and shorter than the diameter.

The feeder unit is adapted to a modified Detroit Power Screwdriver, and uses a mechanical rotating type hopper powered by a  $\frac{1}{2}$ -hp motor. This feeds

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In an iceberg or in a J. K. Smit Diamond Tool only a fraction shows above the surface.

Everyone knows about the unseen portion of an arctic iceberg. Many do not realize the unseen factors that lie beneath the surface of a J. K. Smit Diamond Tool, such as . . . our constant research to find still better methods of manufacturing Diamond Tools, the unquestioned integrity of our company since 1888, the manufacturing skills that have been learned and passed on through all those years, and quality control of manufacture for tool duplication.

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screws at random into a tube which enters a selector unit. The selector then indexes about 30 deg. to a point directly above a feed tube which goes directly to the driver bit. A metal probe determines whether the screw is properly oriented. If not, the selector rotates 180



deg. and the screw is dropped into the feed tube; if it is, the screw is dropped directly without further positioning. The selector then returns to its original position to receive the next screw.

Socket Screw Div., The Bristol Co., Waterbury 20, Conn. **T-11-3**

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175 TO REQUEST ADDITIONAL TOOLS  
OF TODAY INFORMATION

### Epoxy Resin Cement

An aluminum-filled epoxy resin compound, called Metalset A4, is marketed in self-metering tubes. Proper proportions of resin and low-toxicity catalyst are accurately measured automatically by squeezing out identical lengths of each material from its respective tube. The two different colored components are then mixed to a uniform color.

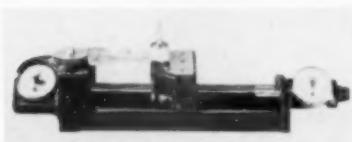
The material can be used as a smoothing and caulking compound, a patching material for metals, wood, plastics, and concrete, and a repair cement. Compounded from the same materials presently used for cementing modern airplane components together, it can be used as an adhesive material for bonding metals, wood, concrete, and glass. It is water and oilproof, resists acids

and alkalis, and is nonflammable. It can be applied to vertical surfaces without sagging and does not lose this quality even after extended storage. Following addition of the catalyst, the material hardens at room temperature. Finished repairs can be machined by conventional methods to a feather edge and will withstand considerable mechanical shock.

Smooth-On Mfg. Co., 572 Communipaw Ave., Jersey City 4, N. J. **T-11-4**

### Gage Indicator

This 25-lb gage, which can be kept in tool or gage crib and issued for specific jobs affords accurate composite check of gears to determine runout, circular pitch spacing, tooth thickness variation, profile error, lateral runout and pin measurement. It provides accurate shaft check-ups for roundness.



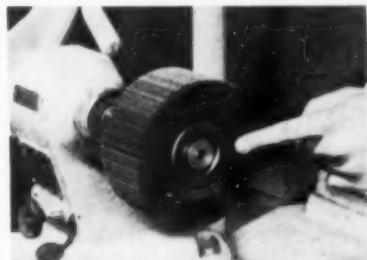
eccentricity, diameter differential, internal ring groove depths, bores and blind recesses. The indicator automatically shows oversize or undersize and the amount. Easily located at machine, Universal Indicating Gage enables operator to accurately and quickly check parts as they are being run.

Bedford Gear and Machine Products, Inc., 550 Krick Rd., Bedford, Ohio.

**T-11-5**

### Finishing Wheels

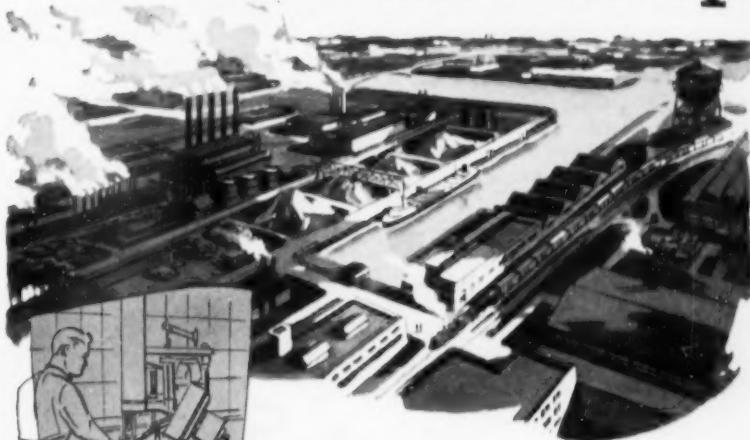
Disposable flanges and a design that permits flush sanding are features of these small coated abrasive polishing



and grinding wheels designated PG, for finishing and maintenance operations.

The flanges, which lock the wheel's coated abrasive leaves in place, are factory installed and bonded to the core. It is unnecessary to remove the flanges when a wheel change is required. The

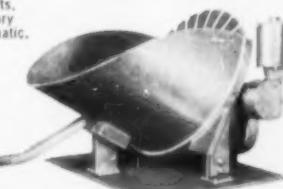
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for light, fragile parts.  
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PG wheel is simply slipped onto the spindle and the cap nut tightened. Performance characteristics of the wheel remain unchanged.

Both flange and end cap nut are recessed into the side of the wheel, so that the wheel can be used flush against the surface. This feature also allows the wheels to be ganged closely to obtain a wide abrasive surface. The recessed flanges are available on all diameters of the 6 through 10 in. diam PG wheel line, and on widths 1½ in. and up.

Specifications for the flanges include a standard 1 in. center hole on wheels 6 in. in diameter; and a standard 1½ in. center hole on wheels with a 7, 8, 9, or 10 in. diameter.

Dept. F7-268, Minnesota Mining and Mfg. Co., 900 Bush St., St. Paul 6, Minn.

**T-11-6**

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*There's NO  
Equivalent—*

*Coromant S6*

**SANDVIK**  
To *Coromant's*  
New Shock-Resistant  
**CARBIDE Grade S-6**

Sandvik Coromant's new S6 carbide is a unique combination of extreme toughness and high wear resistance. It's a super carbide that opens the door to lower machining costs on the toughest, tool-killing applications. These facts give it the ability to handle —

- planing, milling and turning operations on cast steel, heat resisting and stainless steels, scaly materials.
- interrupted cuts, feeds over 1/32".

Phone or write your nearest Sandvik Coromant office for further details.

BB-132

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FREE CATALOG  
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TOOLING  
GUIDE



Covers the complete Coromant line of carbide tools, blanks and inserts, tool holders, combination cutters, end mills, twist drills and scrapers. Also has many useful tables, diagrams, grade recommendations, etc. in technical data section.

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## Abrasive Belt Grinder

This 10 in. abrasive belt grinder, designated Model PD-10, flat surface grinds, polishes and deburrs castings, die castings, forgings, plastics, glass, wood, ceramics, sheet metal and similar parts. Work is done dry.

The machine can be adjusted quickly and easily to vertical or horizontal operating position. The 10 x 21-in. steel platen, which can be reversed top for bottom and side for side, provides a working surface large enough to allow parts to contact the entire width of the belt.

Multi-V-belt drive, 5 or 7½ hp TEFC motor and dynamically balanced drive and driven pulleys assure smooth



operation. Automatic air or spring belt tensioning is available, however, the manufacturer recommends automatic air tensioning for longer belt life and better finishing results. Standard belt speed is 3800 sfpm, but other speeds are available.

Hammond Machinery Builders, 1661 Douglas Ave., Kalamazoo, Mich.

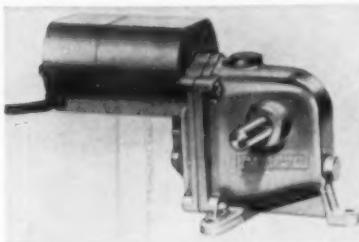
**T-11-7**

## High Torque Power Unit

This gearmotor, which weighs less than 5½ lb, is equipped with a Universal electric motor with a rating of ½<sub>15</sub> hp. It also is available in ½<sub>10</sub> and ½<sub>6</sub> hp. All motors are wired for instant reversing.

These power units are available from stock in six different ratios from 1787:1 to 52:1 producing up to 450 in-lb torque. Output speeds, at full load, range from 2.8 to 100 rpm, and special ratios and voltages are also available.

The unit has over-all length of 8½ in.

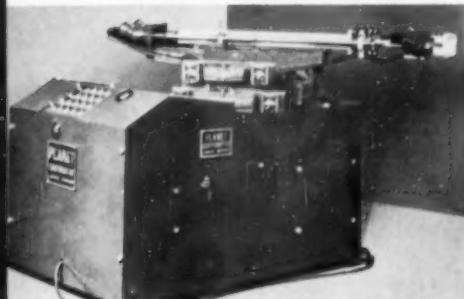


Gears, precision cut and totally enclosed in a zinc diecast housing, are lubricated for life. This gear-motor is particularly adaptable when a manufacturer requires a small, compact and light weight unit with an extremely high torque and at a very low cost.

The von Weise Gear Co., 9353 Watson Industrial Park, St. Louis, Mo. **T-11-8**

## Automatic Handling Machine

This universal transfer device, designed to simulate use of an operator's arm, wrist and hand, has an extended arm which can be made to produce five basic motions. The grasping device on the horizontal arm opens and closes, and rotates 360 deg; the arm will extend or retract, raise or lower, and rotate 270



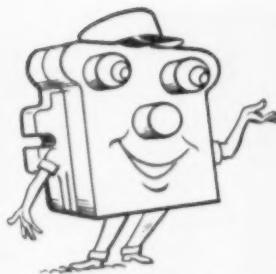
deg in a horizontal plane. In all, this machine, called the Planobot, is capable of performing 25 individual movements during any one cycle or sequence. Adjustments can be made in a matter of minutes to set the machine for an entirely different cycle of operation.

Planet Corp., Lansing, Mich.  
**T-11-9**

## Lathes

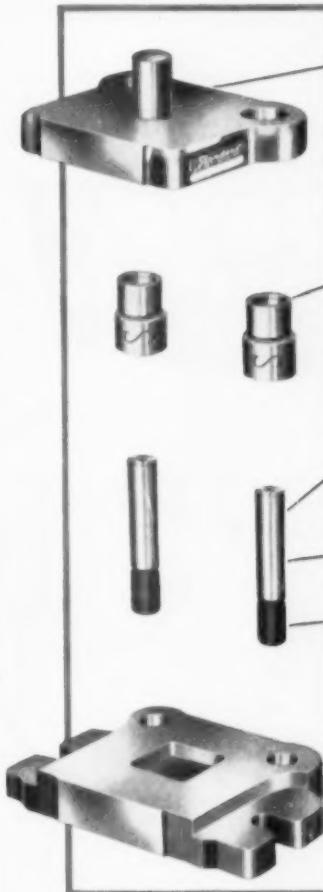
All-gear head lathes for toolroom and production turning are available as Model 2013 with 21-in. swing-over bedways and Model 2516 with 25-in. swing-over bedways.

The head makes available 32 spindle speeds from 13 to 1500 rpm through crowned, flame-hardened spur gears. It is also available with maximum speeds of 1000 rpm or 2000 rpm. Use of spur



Stan the die set man says:

**These details make the difference...**



**Punch and die holders fully stress relieved** — when you lay out work on a "Standard" die set, the dimensions "stay-put" because "Standard" uses a metallurgically correct stress relieving process which produces great dimensional stability.

**Bushings — hardened, ground, and honed** — provide full-length bearing for longer wear. Pre-shrunk in deep freeze for stress-free assembly into punch holder.

**McVey Design Precision Posts** (pat. applied for) for fast, easy assembly and disassembly of die sets — without hammering or pounding.

**Posts chrome-coated** for low friction and long wear.

**Posts pre-shrunk in deep freeze** for precision assembly into die holder holes. Bond of post in plate helped by Pentrate finish of post end.

**Special Machine Work** further stress relieved for added assurance of dimensional stability and precision fit of posts and bushings.



Send for Die Set Comparison Chart and see for yourself why experienced tool and die makers specify and insist on "Standard" every time.

**YES, there's a difference**

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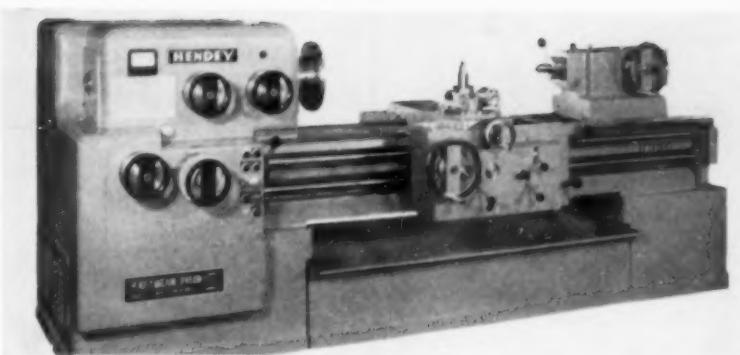
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gears permits a large number of speed changes by merely shifting gears, reducing the number of headstock clutches. Only two handwheels are used to select and shift spindle speeds, which are in geometric progression.

Threading features of the machine include the multiple-thread indexing spindle which permits cutting any number of threads divisible into 48.

Built-in thread-chasing dial on top of front permits the operator to move the carriage quickly back to any position when cutting an even or odd thread.

Selection from 66 thread and feed

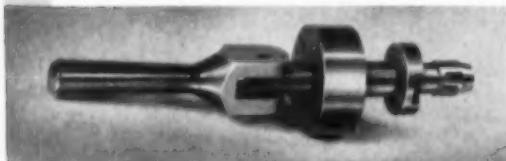


Add accuracy to your work—with

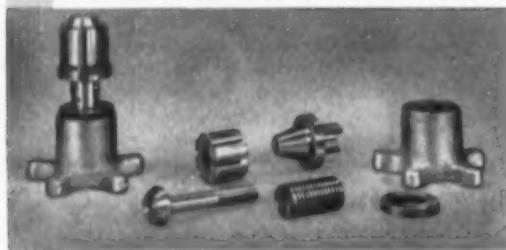
## SPEEDGRIP EXPANDING LOCATORS Outmode Solid Pin Locators

In loading or unloading work from fixtures, with Speedgrip Expanding Locators you can obtain location tolerances within .0002".

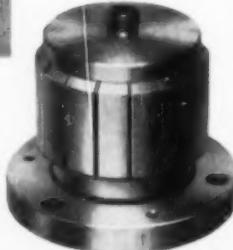
- Guaranteed to repeat fixture location accurately.
- Assures easier loading and unloading of work.



#0 Speedgrip Locator with cam lever actuation. With corresponding bushings, this locator will accommodate bores from  $\frac{1}{2}$ " to  $\frac{3}{4}$ " dia.



This #5 locator can be supplied for either wrench or draw bar actuation. Has precision ground pilot on under side of flange for mounting to fixture. With expandable bushings this locator can accommodate bores ranging in size from 5" to 11" dia. Locators, with various means of actuation can accommodate bores, ranging from  $\frac{3}{8}$ " to 11".



## SPEEDGRIP CHUCK

Division of ERNEST, HOLDEMAN & COLLET, INC.

Elkhart, Indiana

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for detailed description.

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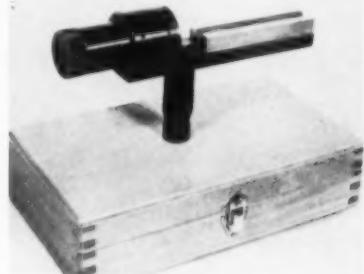
changes is made through two dials on the gearbox. Quick-change threads per inch range from 2 to 120; feed range is from 0.0015 to 0.091 ipr.

The lathes can be furnished with a 15, 20, or 25-hp spindle drive motor and come equipped with a load meter and spindle speed selector plate.

Hendey Mach. Div., Barber-Colman Co., Rockford, Ill. **T-11-10**

## Drill Test Microscope

Twist drills from  $\frac{1}{16}$  to  $\frac{7}{16}$  in. diameter may be tested on this German test microscope, which has two optics. The larger lens checks the concentricity of the chisel edge, while the



smaller one checks the point angle and a normal relief angle of 6 deg.

Drills within the range can be checked quickly before they are put to work.

W. Von Arnauld Co., 95 Grove St.,  
Oakland, N. J. **T-11-11**

## Abrasive Belt Grinder

A line of pinch roll belt grinders finishes titanium, stainless steel or carbon steel flat stock to precise gage thickness in a single pass. Four machine sizes are available, providing capacities of 36, 48, 60 and 72 in. Feed roll speeds are adjustable from one to 100 fpm.

Belt drive and an idling mechanism provide for belt travel over four rolls designed in a diamond shape. This ar-

angement, together with the 20-ft long, 3-in. belt, provides good flexing and chip removal, plus allowing the belt to remain cool and free-cutting during long periods of operation.

Belt adjustment is through the top idler roll that can be adjusted vertically for correct tension and cambered for automatic belt alignment.

An attachment for spraying coolant or lubricant on either the abrasive belt or work is available. This can be arranged for manual or automatic operation.

The machine is designed for handling both polishing and stock-removal jobs, and can be used to reduce rolling mill



gage tolerances. Test runs indicate thickness can be held within 0.0015 in.

Photoelectric cell control of the grinding aperture can be provided as an optional feature.

The No. 456 pinch roll grinder is able to work in either direction. Feed and work roll design are such that material can be fed with the rotation of the belt or against it with equal efficiency.

Belts can be changed in a matter of minutes.

Mattison Machine Works, Rockford, Ill.

**T-11-12**

## Two-Flute End Mills

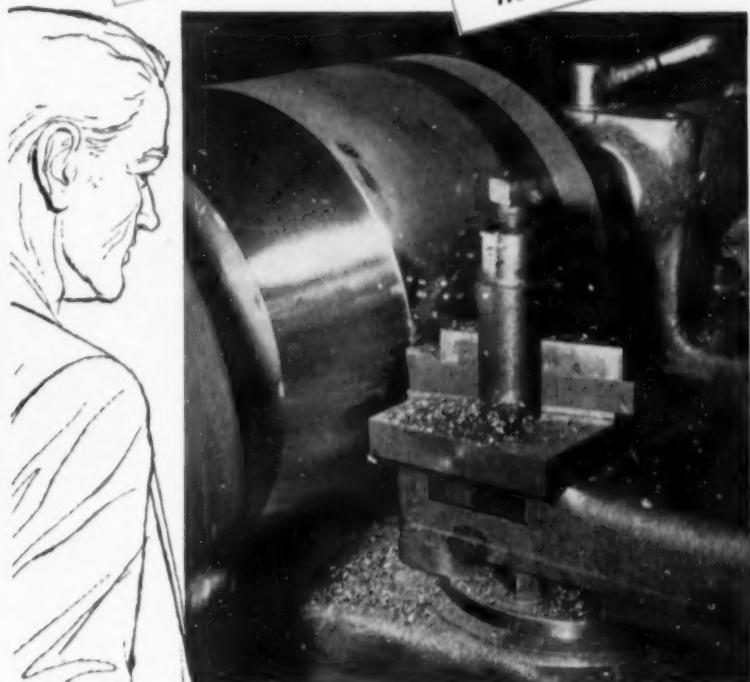
A line of two-flute Hy-Spiral end mills provide the proper shear cutting action for fine finishes and long tool life when milling nonferrous materials.

Available in regular, long and extra long types, these general purpose high-speed end mills were developed primarily for aircraft forging tracer milling. In addition to tracer milling applications, they also may be used for slabbing, cavity and deep-pocket milling, and slotting in nonferrous materials.

Proper rake angles and cutting edge relief insure efficient milling in both the soft, gummy, nonferrous materials and the harder alloys. Cutting edges of the mills are so relieved that there is no build-up. The cutting edge relief is ground so that maximum strength is retained directly behind

Production increased  
up to 10 Times!

costs reduced as  
much as 75%



## with *Stupalox*<sup>®</sup> oxide cutting tools

Again and again the use of these high strength, high density aluminum oxide cutting tools in actual field service has produced sensational results—accelerating production and slashing costs. Field service reports were astounding—production doubled . . . tripled . . . quadrupled; costs cut 33% . . . 60% . . . 75%! A triumphant achievement—fully justifying the thirty years which Stupakoff research engineers devoted to its development.

But that's not all. The use of Stupalox oxide cutting tools has also resulted in faster machining cycles, smoother finishes, and longer tool life. That's because of the extreme hardness of the tool material which stands up to temperatures of 2000°F and higher, and its resistance to corrosion by the strongest acids and chemicals normally encountered in machining operations. For complete technical data, write for Catalog 257 today.



**STUPAKOFF** DIVISION OF  
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these cutting edges, to aid in dissipation of cutting edge heat.

Wide, highly polished flutes and high helix angle insure positive chip ejection and prevent cutting-face build-up, even in deep pocketing applications.

Regular and long types of Hy-Spiral end mills are made in sizes from  $\frac{1}{4}$  to 2 in. diam. Extra long type is made in sizes from  $\frac{1}{4}$  to  $1\frac{1}{2}$  in. diam.

The Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

T-11-13

## ROCKFORD



### Single or Double CLUTCHES Control Power Better

Millions of power-driven vehicles and machines are operating more efficiently than was calculated in their original specifications—by using ROCKFORD clutches that are exactly suited to their particular needs. A ROCKFORD engineered-for-the-job application may be the means of improving the operation of your product. Certainly it will pay you to investigate the possibility. During the past quarter century, ROCKFORD has accumulated a fund of useful information about the transmission and control of power thru clutches. This know-how is available for the use of your engineering department, upon request.

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Shows typical installations of  
**ROCKFORD CLUTCHES**  
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### ROCKFORD Clutch Division BORG-WARNER

1329 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales: Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.



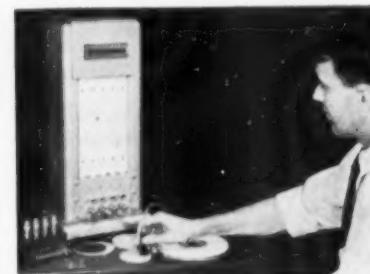
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162

### Grinding Wheel Gage

Fast, nondestructive comparative tests of density uniformity in grinding wheels, honing sticks and other abrasive tools and products can be carried out effectively by this grinding wheel gage.

The instrument, consisting of either a three or four-column Precisionaire,



flows air into the grinding wheel and gages the flow by means of scale graduations. While graduations have no relationship to abrasive grain sizes, the gage quickly and accurately compares and checks uniformity.

The gage positively detects filling and provides an accurate method of exploring structural variations.

The Sheffield Corp., Dayton 1, Ohio.

T-11-14

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OF TODAY INFORMATION

### Air-Operated Press

Air-operated shop press is available in 25, 50, 75, and 150 ton models. It is particularly designed for bending, straightening, and other press work that must be completed in minimum



The Tool Engineer

time. Only requirement for operation is availability of compressed air.

Feature of the machine is the rapid ram approach which eliminates the use of a handwheel. When the control knob is turned, the ram advances at high speed until it comes in contact with the work—then automatically changes to the power stroke. The knob automatically turns to "Off" when the hand is removed. A safety valve protects against overload.

The self-contained workhead is readily movable (on roller bearings) to center over the work. The ram has a full 10-inch stroke. The workhead unit may also be purchased separately.

Dake Corp., Grand Haven, Mich.

**T-11-15**

### Milling Cutters

Dual purpose, high helix plain milling cutters for machining both aluminum and ferrous materials have a 52 deg left hand helix and 12 deg hook.

The high helix angle prevents hogging in when the cutter is entering or leaving the workpiece. This feature makes the tools suitable for light cuts



on thin springy pieces or intermittent cuts on frail parts. The design also results in an unusually free cutting action.

Cutters are supplied with cutting edge clearance angles suitable for the material being machined. Cutting edges can easily be recleared when the cutter is used on a different material. Cutter tooth and chip spaces are ground and polished to facilitate chip disposal.

Five cutter sizes are standardized, ranging from 4 to 8 in. in width.

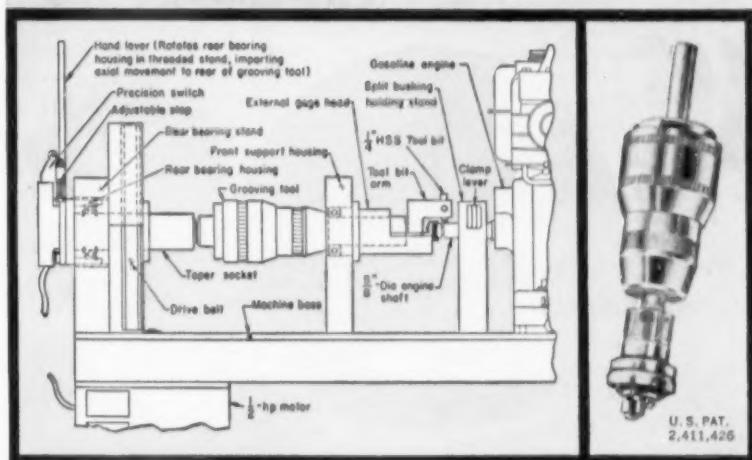
Goddard & Goddard Co., 12280 Burt Rd., Detroit 23, Mich. **T-11-16**

### Parts Feeder Accessory

An automatic orientor feeds parts into a hobber properly positioned for back-to-back hobbing.

Parts enter the drum-type alternator aligned the same way and are gravity fed into the drum from an overhead distribution system. A positive stop permits only two parts to enter the alternator at any one time. Limit switches, actuated by the machine cycle, move spring-loaded pawls which release a swinging arm to rotate one of the two parts 180 deg. The parts are then in a back-to-back position but on opposite

## Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



To install a small gear, Clemson Bros. must machine a recess (Tolerance:  $+.033" - .000"$ ) in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary

and using a tool that rotates—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool.



**WALDES**  
**TRUARC**<sup>®</sup>  
**GROOVING TOOL**

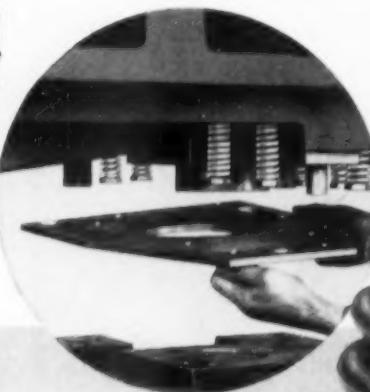
WALDES KOHINOOR, INC.

47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

TE119

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# "WALES *Strippits* CUT OUR DIE-MAKING COST OVER 30%!"

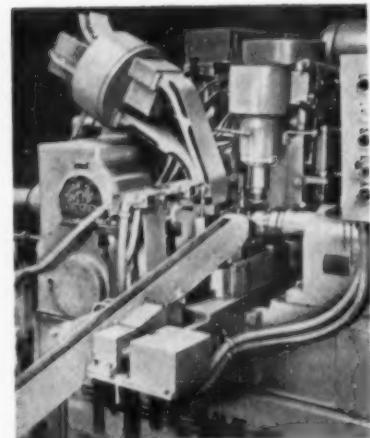


"Die building was speeded up and costs cut when we standardized on Strippits, replacing conventional die springs. Strippits eliminated counterboring for springs or stripper bolts, which also permits use of lighter die shoes. Only light stripper plates are necessary. For many dies, the even pressures and positive lengths of the Strippits eliminate the need for stripper plates or pressure pads altogether." Production shops, too, benefit from Strippit-equipped dies. No need to remove dies from your press to repair broken punches or springs. See illustration. Each Strippit is factory adjusted and tested to assure uniform preload and stripping force. A complete line of Strippits is available from stock to meet all your requirements.

SEND FOR BULLETIN NO. 26K.  
The STRIPPIT story should interest  
you. Send for your copy today.

**WALES *Strippit* COMPANY**  
A UNIT OF MOUDABUR INDUSTRIES INC.  
AKRON, NEW YORK  
WALES-STRIPPIT OF CALIF., SOUTH GATE, CALIF.  
WALES-STRIPPIT OF CANADA LTD., HAMILTON, ONT.  
"...the Wales-Way is the PLUS-PROFIT way"

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-11-164



sides of the drum. Two escapement mechanisms allow each one to slide down its independent track. The tracks merge at the input end of the machine feed slide where the parts drop into a slot in proper position to be mechanically shuttled to the arbor of the machine.

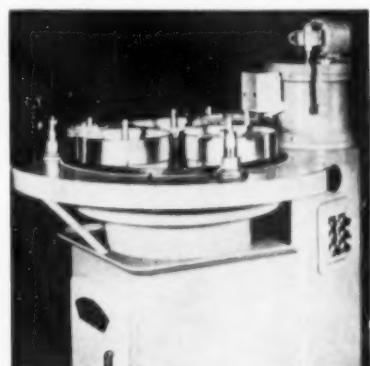
Set up as illustrated for back-to-back hobbing of small pump gears on a Model 1445 Michigan hobber, the parts alternator does feeding in a loading time of four seconds for two gears.

Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. **T-11-17**

## Flat Lapping Machine

The Gyro-Matic 24 flat lapping machine combines automatic pushbutton operation with frictional drive work retainer rings.

Including a 24-in. diam antidistortion lapping plate, the machine is designed



for production line precision lapping and finishing of all types of flat parts. Each of three work holder rings accommodates piece parts up to 9 3/4 in. diameter. Double duty frictional drive parts retainer rings both retain and guide work while conditioning lapping plate during cycle.

Other features of the tool are push-

**The Tool Engineer**

button operation and JIC electrical controls. Grit build-up around the abrasive control outlet is prevented by an aperture metering disc. Depending on the individual lapping or finishing job at hand, an operator adjusts the metering disc to the outlet size required and a steady stream of abrasive compound flows through. Because of this feature, coupled with the abrasive agitator paddle, abrasive suspension is always correct.

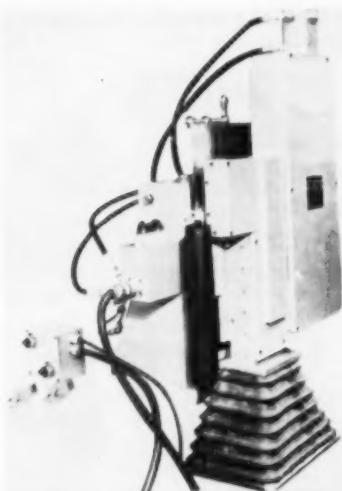
Spitfire Tool and Machine Co., 2931 N. Pulaski Rd., Chicago 41, Ill. **T-11-18**

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Wheel Dresser

Hydraulic contour wheel dresser, designated Model 86, is available for use on cylindrical grinders. Dressing diamonds are optically set in the microscope fixture so that no dresser adjustments are necessary when changing diamonds.

Profile widths up to 6 in. and profile depths up to 3½ in. can be handled by



the tool. Hydraulically operated, it may be tied directly into the grinding cycle for automatic operation. Where applicable, uniform peripheral diamond dressing speed is possible.

Hoglund Engineering & Mfg. Co., 343 Snyder Ave., Berkeley Hts., N. J. **T-11-19**

## Sluriator Kit

Designed to prevent solid packing of abrasive at the bottom of the Pangborn Hydro-Finish equipment tank after overnight shutdown, this tool, called the Sluriator, keeps the particles thoroughly slurred in water for various cleaning and finishing operations. There is no need for a mechanical pump and

auxiliary equipment. The unit can be adapted to conical-bottom tanks by means of a conversion kit.

The Sluriator consists of a 4-inch diameter compressed air distributor set between two circular plates. Two such fittings are installed at the base of the sloping side walls of the abrasive slurry tank so that the agitating air sweeps the tank bottom and spirals through the body of the liquid to provide rapid and thorough agitation of the slurry.

The only equipment required to supply the new Sluriator is a take-off from the regular 80 to 90-lb compressed air line necessary to operate the nozzle, and a needle valve to regulate the air flow through the Sluriator heads at 6 to 10 cfm.

Pangborn Corp., Hagerstown, Md. **T-11-20**

## Hydraulic Press

Small, high-efficiency pumpless and motorless hydraulic press for plastics molding, laminating, compacting, etc. takes its power of 8 to 9 psi from the regular shop air line.

Standard model of the press, called the Hydrolair, have "moving-up" platen. The specially built unit illustrated, however, has a "moving-down" platen specifically designed for a special assembly operation. The housing containing the controls permits mounting a loading and unloading table at the same level as the press bed.

This press is manually operated, with a 50-ton pressure capacity. The air-oil reservoir, Elmes air-hydraulic intensifier, hydraulic cylinders, and practically all the hydraulic circuit are enclosed

**No other machine of comparable size can equal it for ACCURACY — CAPACITY — SPEED — CONVENIENCE**

**KNIGHT'S New  
VERSATILE VERTICAL  
No. 60 for  
PRECISION  
BORING & MILLING**

**TWO TABLE SIZES**  
18" x 52"—28" longitudinal travel  
18" x 60"—36" longitudinal travel

**UNUSUAL CAPACITY**—18" table cross feed, 30" vertical travel, deeper throat

**RUGGED BED-TYPE TABLE**—3-way bearing; bed 36" wide, saddle 46" long

**MORE VERSATILITY**—No more work transfers for milling, drilling, boring. Eliminates extra setups

**GREATER ACCURACY**—Handscraped bearings; spindle double mounted in roller and ball bearings. Fixed bed with stronger supports, less overhang

**EASIER OPERATION**—Convenient, simple controls. Longitudinal handwheel in front; counterbalanced spindle and spindle head are easily moved. Automatic safety controls

**CHOICE OF 3 MEASURING DEVICES**—Hardened and ground precision screws, locating counters, dial indicator equipment



**W. B. KNIGHT MACHINERY CO.**

3918 West Pine Blvd., St. Louis 8, Mo.

**ATTACH  
TO COMPANY  
LETTERHEAD**

W. B. KNIGHT MACHINERY CO.  
3918 West Pine Blvd., St. Louis 8, Mo.  
Send complete information on new No. 60 Vertical.

Name \_\_\_\_\_

Title \_\_\_\_\_

Have representative call.

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-11-165



M1238-1818 — Range 18" x 18", working distance 9" to infinity. Reads to 0.001" up to 24" working distance. Protractor ocular reads to 3 minutes of arc. Image is erect.

**Cut inspection time in half with new Gaertner Coordinate Cathetometers**

These convenient, reliable optical instruments permit making precise coordinate measurements in a vertical plane. The two dimensions are measured with one setting, object does not have to be rotated. Inspection time is cut in half and resetting errors eliminated.

Versatile Gaertner Coordinate Cathetometers are ideally suited for precision measurements on large objects; also objects or points in recessed, remote, or inaccessible locations. Applications include measuring jet engine sections, complicated castings, printed circuits, bolt holes and bosses on large piece parts, traces on cathode ray tubes, etc.

Because these are optical rather than mechanical measuring instruments, you make non-destructive measurements without contact, distortion, or concern about pressure being applied to the object when making a setting. Instruments available in English or Metric system.

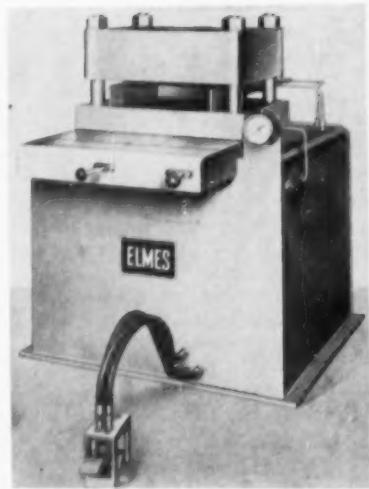


Visit our booth  
National Metal Exposition & Congress  
International Amphitheatre  
Chicago • Nov. 4-8

Write for Bulletin 194-57

**The Gaertner Scientific Corporation**

1241 Wrightwood Ave., Chicago 14, Ill.  
Telephone: BUCKingham 1-5335  
INDICATE A-11-166



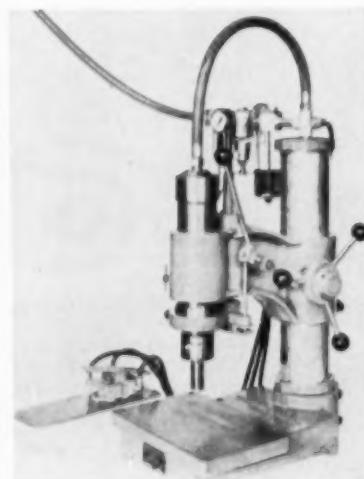
in the base cabinet for protection. Simple removal of a cover plate permits easy maintenance inspection of the operating system.

Standard Hydrolairs are available in 30, 50, 75 and 100-ton models, with manual control, with or without hot plates. The 50-ton model is also available with electric pushbutton control.

American Steel Foundries, Elmes Engineering Div., 1150-Z Tennessee Ave., Cincinnati 29, Ohio. **T-11-21**

**Repeating Air Hammer**

Model 300-RH heavy-duty repeating hammer will repeat at from 1,000 to 2,500 times per minute depending on the air pressure used, as long as contact

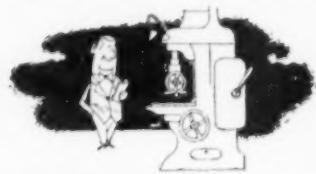


pressure is maintained. An air-traverse mechanism controlled by a foot valve lowers the hammer cylinder to bring the impact tool down onto the work and hold it there during the work cycle. Valving is internal and is actuated by this contact. Upon release of the foot

**ATTEND THE 1958 ASTE TOOL SHOW**

CONVENTION CENTER PHILADELPHIA MAY 1-8

**SEE** all the very latest advances and improvements in more than thirty major categories of industrial products.



**ATTEND** top-level conferences, conducted by recognized authorities on the newest production techniques and developments.



**MEET** and exchange ideas with management, engineering, production, sales people from the nation's leading industrial concerns.



**INSPECT** the modern equipment and up-to-the minute manufacturing methods being utilized in booming Delaware Valley plants.



**AMERICAN SOCIETY**

TOOL SHOW CONFERENCE '58 MAY 1 TO 8  
OF TOOL ENGINEERS

pedal the hammer cylinder is lifted away from the work.

On low air pressure of 20 psi the hammer has a gentle action and will handle delicate staking, crimping, and riveting. At 100 psi it will rivet  $\frac{1}{8}$  in. diameter mild steel.

The tool is keyed against rotation and is precision fit with the collet. It will repeat without wandering or wobbling. A depth stop may be set to limit the work progress.

The cylinder and head frame assembly may be used as a component on automatic machines and may be mounted at any angle.

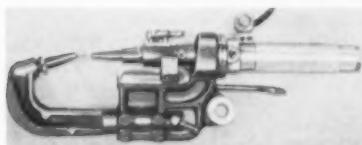
Heidrich-Nourse Co., 631 E. Third St., Los Angeles 13, Calif. **T-11-22**

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Welding Gun

In this portable welding gun, incoming water reaches the welding point through a tube that is insulated by the return water jacket. The jacket has capacity 5 times that of the in-flow tube, and heat transfer to the in-flow tube is minimized.

The gun is designed to use a pin in place of a shunt. A built-in guide for



the moving jaw prevents wear on the fulcrum pin in event the gun is used in cocked position.

The line of guns includes C and scissors types with either upper or lower jaw operating.

Allied Welder Corp., 8700 Brandt, Dearborn, Mich. **T-11-23**

## Automatic Drilling Unit

Positive drill head, that can be used for semi or fully automatic operations, is adaptable to multiple drilling and reaming. It quickly interlocks with other units or equipment for drilling, reaming, tapping, counter-boring, centering or countersinking. The head may be



### Stop tap breakage and scrap

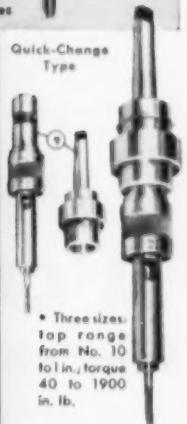
## SCULLY-JONES SAFE-TORQUE DRIVERS

NOW AVAILABLE IN NEW STYLES  
AND CAPACITIES

These benefits . . .	for these reasons . . .	result from these PREMIUM features
<b>PREMIUM TOOL LIFE</b>	<b>Reduce tap breakage.</b> <b>Control adverse tapping conditions.</b>	1. One-shot clutch and cam-drive collet completely disengage tap from driver. 2. Pre-set torque remains constant. Wide range of settings.
<b>PREMIUM QUALITY TAPPED HOLES</b>	<b>Produce uniform, accurate threads.</b>	3. Freewheeling action eliminates impact and objectionable vibration. 4. Releases instantly at proper setting. 5. Tension and compression type compensates for feed variation between spindle and tap.
<b>PREMIUM PRODUCTION EFFICIENCY</b>	<b>Help prevent use of dull or improperly sharpened tap, or wrong tap for job.</b> <b>Operator gains confidence, more free time for other work.</b> <b>Use higher speeds on all tapping jobs.</b> <b>Reduce down-time.</b>	6. No noise or impact on release. Tension and compression type spring loaded. 7. Operates at any speed taps can take. 8. Gives dependable control over adverse machining conditions. 9. Quick-change type — change tools without stopping machine.
<b>PREMIUM PROFIT OPPORTUNITY</b>	<b>Driver has long service life.</b>	10. Freewheeling action minimizes wear.



**Heavy-Duty  
Safe-Torque  
Tap Drivers**  
• Two sizes: tap range from  $\frac{1}{2}$  to  $1\frac{1}{2}$  in., torque 500 to 2400 in. lb.



**Quick-Change  
Type**



• Three sizes: tap range from No. 10 to 1 in., torque 40 to 1900 in. lb.



**Tension  
and  
Compression  
Type**

• Two sizes: tap range from No. 10 to  $\frac{1}{2}$  in., torque 50 to 700 in. lb.



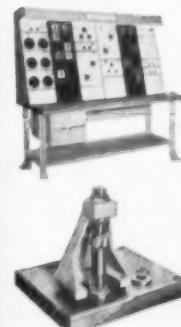
Call your Scully-Jones factory-trained representative or distributor for complete information and prices.

### PRECISION HOLDING TOOLS

"Precision Holding" for holding precision

Scully-Jones and Company, 1915 South Rockwell St., Chicago 8, Ill.

### For profit-minded tool buyers!



**"TOOLITROL"  
BOARDS**  
Take the human element out of multiple-spindle operations, help control quality and production.

**NEW TENSION AND  
COMPRESSION  
TAP HOLDERS**  
Lock-and-eject chuck speeds tool changes, increases holding power.

**HEAVY-DUTY  
TAP DRIVERS**  
Improved snap-ring design increases accuracy and holding power, speeds tool changes.



**PRESETTING TOOLS**  
Reduce setup time, down-time, and inspection time by as much as 50 percent.

**TURRET  
TOOL  
HOLDERS**  
Hardened and precision ground to resist nicking and wear, assure accurate tool alignment.



**CLOSE CENTER  
TAP DRIVERS**  
New design with four-slot chuck increases resistance to pull-out, keeps taps running true.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-167

used for end or hollow milling, tube flaring, tube facing, chamfering, deburring, boring, and is adaptable to base or end mounting. It has assured, accurate depth control.

Available with 6 in. frame, it has 2½ in. stroke; with an 8 in. frame, it has 3½ in. stroke. Speeds range from 245 to 8640 rpm, and horsepower is from 1/4 to 7.5.

Bedford Gear and Machine Products, Inc., 550 Krick Rd., Bedford, Ohio.

T-11-24

## New McCROSKEY Series "900" Milling Cutters for Milling with "THROW-AWAY" Carbide Inserts

These new cutters eliminate the time and cost of regrinding blades. They reduce the investment in cutters needed to handle a wide variety of work;—cut milling costs;—and provide users with all the other time and cost saving advantages of milling with "Throw-Away" carbide inserts.

Our widely used, patented Super-Jack® Wedges hold the inserts solidly against ground surfaces in the body, preventing any movement even under heavy feeds and speeds, assuring utmost efficiency and dependability. Inserts can be unlocked easily, and indexed quickly and accurately on the machine, providing almost uninterrupted production. Interchangeable with conventional cutters, 16 standard sizes including face and end mills, 4" to 12" diameter. Also "Specials" to meet any requirement. Get full details. Write for our new Bulletin No. 572—Today!

U. S. Patents 2,508,437, 2,547,789, 2,632,536

### The complete McCrosky line includes:

Jack-Lock® Milling Cutters      Wizard® Quick-Change Chucks  
Super® Adjustable Reamers      Block Type Boring Bars  
Turret Tool Posts      Specially Engineered Multiple Operation Tools

Gaily descriptive catalogs sent promptly on request. Write for yours today!



# McCROSKEY

Engineering and Sales Representatives in the Principal Cities  
FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-11-168

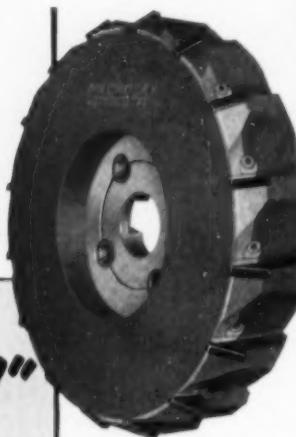
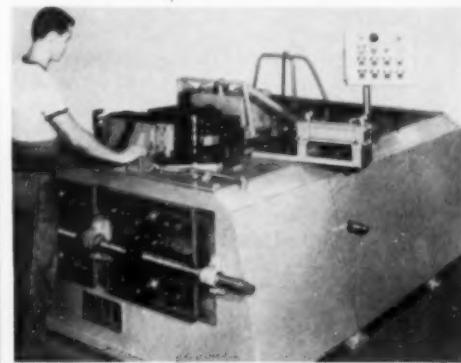
## Punch Press and Bender

Automatic, hydraulic powered, high-speed combination horizontal punch press and multiple bending machine simultaneously pierces and countersinks holes, flattens, coins weld projections, and produces multiple bends in two tubular parts at a net production rate of 1,440 pieces per hour. Machine cycle requires 5 sec.

The machine can be operated as either a fully automatic or manually

controlled type. A pushbutton panel includes controls for single and automatic cycle, as well as controls for inching each machine function. All controls are interlocked to prevent machine or die damage during setup operation. The machine also can be used as a horizontal punch press without bending.

Wing dies on the machine can be reversed in both position and action to



Standard 12" No. 967-T  
Face Mill Fitted with Triangular Carbide Inserts



Square Carbide  
Insert



Triangular Carbide  
Insert

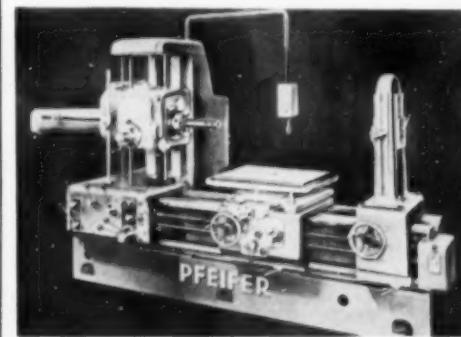
form S-shaped sections. The bed construction permits the addition of hydraulic cylinders for forming, piercing, flattening and cutoff operations after the bending is done.

Wing dies are interchangeable for bending. Right and left-hand lead-screws at the side and front of the combination machine permit adjustment for a variety of bending radii.

Walter P. Hill, Inc., 22183 Telegraph Rd., Detroit 19, Mich.      T-11-25

## Boring Mill

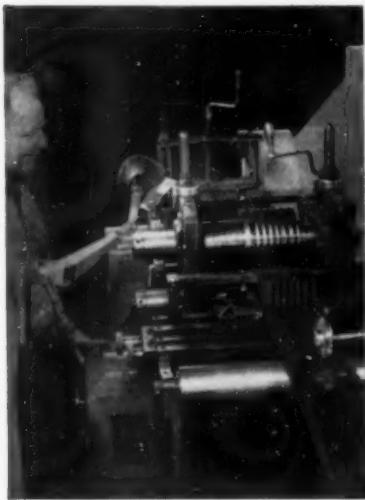
Using design principles employed in lathes, this German-made Pfeifer boring mill has its spindle head at the left of



the bed. Operational controls are centrally located for easy reach.

Four covered and hardened guideways assure accurate vibration-free saddle traverse.

Universal range of application of this precision turning, boring and milling machine make it useful for jobs requiring



## YODER SLITTERS Supply Varied Strip Widths for Tinnerman *Speed Nuts*

Tinnerman Products, Inc., Cleveland, Ohio, produces more than 10,000 different shapes and sizes of "SPEED NUT" brand fasteners for industry . . . many of them to special specifications.

To do this, Tinnerman uses slit steel strands ranging in width from  $\frac{1}{8}$ " to  $7\frac{1}{2}$ ". To carry an inventory of the many strip widths required to meet normal and unusual demands would be almost impossible.

Tinnerman overcomes these inventory and supply problems by doing their own slitting on two Yoder slitters. This enables them to supply the plant with any strip size required from a relatively small inventory of 6" and 9" width purchased coils. In slitting narrow strands, such as these from small coils, a Yoder slitter may be profitable on a production as low as 25 tons per month.

Here is a fine example of how a small investment in Yoder slitting equipment greatly simplifies and speeds production while effecting important operating economies. The saving made in time alone, reflects in better customer service through faster completion and delivery of finished products. If your steel strip or sheet slitting requirements are as low as 100 tons per month or even less, a medium size Yoder slitter can be a very profitable investment for you. The Yoder line includes units of every size and capacity . . . of the most advanced engineering design. Send for the Yoder Slitter Book — a comprehensive text on the mechanics and economics of slitters and slitting line operation, with time studies, cost analyses and other valuable data. Write to:

**THE YODER COMPANY**  
5525 Walworth Avenue • Cleveland 2, Ohio



**ROTARY  
SLITTING  
LINES**

INDICATE A-11-169-1

November 1957

ing employment of dial indicators and gage blocks, use of optical measuring devices, turning of bulky pieces, thread cutting, and thread grinding.

One-piece, well-ribbed bed extending over the entire length of the machine and through the massive, heavily ribbed column assures maximum strength.

Distributed by Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.

T-11-26

### Chucks

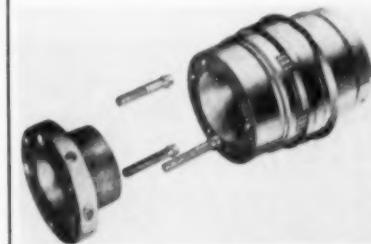
Two gear chucks, designed with friction free ball thrust bearing between the chuck body and gear nut, have been introduced as the Series 20 ball bearing geared chuck line. These chucks are constructed so that they grip with greater force than conventional chucks with the same key tightening effort.

Ball races are formed directly in the hardened chuck body and in the one piece gear nut. Simple construction and the few number of parts used minimizes maintenance requirements.

Supreme Products Corp., 222 S. Calumet Ave., Chicago 16, Ill. T-11-27

### Flexible Couplings

This line of flexible couplings, taper-bored for use with "QD" taper bushing, is available in six different sizes ranging from 22 to 150 hp at 1750 rpm. Stock bushing bore sizes begin at  $\frac{1}{2}$  in. and progress to  $3\frac{1}{2}$  in. by sixteenths of an inch. They provide a coupling-bushing



combination that affords easy fastening to the shaft with the firmness of a shrunk-on fit.

The new couplings are designated CQD-152 for SD bushings, CQD-191 for SK bushings, CQD-226 and CQD-276 for SFG bushings, and CQD-280 and CQD-285 for CE bushings.

Lovejoy Flexible Coupling Co., 4978 W. Lake St., Chicago 44, Ill. T-11-28

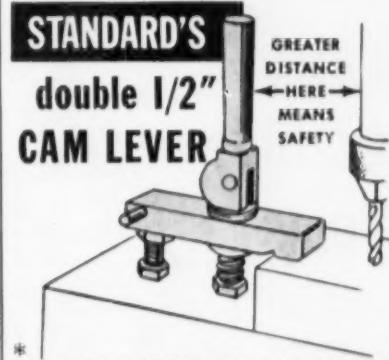
### Industrial Jacks

These worm gear screw jacks can be used in any position and are designed for precision jacking, pushing and pulling operations, and for linear actu-

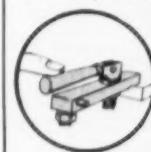
# \*CERTIFIED ... up to 3,450 lbs. clamping force

### STANDARD'S

#### double 1/2" CAM LEVER



\* THE JAMES H. HERRON CO., (Laboratories for Testing, Analysis and Inspection) reports as follows: "With reference to the Double Cam Lever (500) and Eye-Bolt (500), we have conducted experiments to determine the amount of clamping force a man can exert with this device, lubricated. "Without the use of any auxiliary equipment, it was found that a man could exert up to 3,450 pounds, by bringing the lever to a position 90° with the Eye-Bolt."



**Finger Tip Can  
Tighten Clamp.**

**Easy to Use—  
Positive Action**

- Standard's Double Cam Lever offers maximum job clearance.
- Safe Operation—with handle vertical before clamping (as illustrated).
- Constant Maximum Clamping Pressure—perpendicular to center line of lever.
- Certified 6-Ton Back-Pressure Resistance—no danger of cam backing up.
- Ready to Use—no altering needed on assembly.
- No Lever Breakage—solid steel handle.
- This Cam can be applied to your Specially Designed Assemblies. Quotations on request.

### OVER 500 OTHER STANDARD JIG AND FIXTURE COMPONENTS

Standard Parts Company offers the most complete line of fine quality tool room standards available today. You can depend on Standard Components—they will never let you down.

\*\*\* TWX BEDFORD, O. 462 \*\*\*

**WRITE FOR YOUR COPY  
FREE CATALOG**  
(SIXTH EDITION)

Illustrating our complete line of top quality jig and fixture parts.



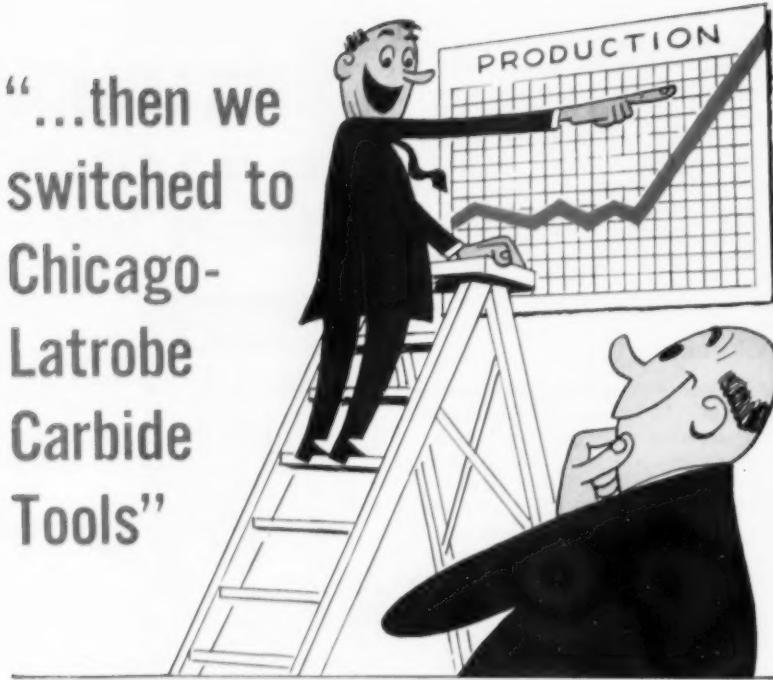
**STANDARD PARTS CO.**

1012 BROADWAY • BEDFORD, OHIO

INDICATE A-11-169-2

169

**"...then we switched to Chicago-Latrobe Carbide Tools"**



In hundreds of plants and shops, Chicago-Latrobe Carbide Drills and Reamers are helping to establish new production records. Reason? They run longer between

grinds . . . they have stamina that permits faster feeds and speeds. And—they are available when and where you need them. Try them . . . call in your Chicago-Latrobe Distributor. He'll serve you promptly . . . advise you wisely.

**Chicago-Latrobe**  
CARBIDE  
**Drills and Reamers**  
FROM YOUR C-L DISTRIBUTOR

DRILLS • REAMERS • COUNTERSINKS • COUNTERBORES • GUN DRILLS • CARBIDE AND SPECIAL TOOLS

**CHICAGO-LATROBE**  
434 W. ONTARIO STREET, CHICAGO 10

Offices and Warehouses in: New York, Detroit, Chicago, Los Angeles

FOR FURTHER INFORMATION, USE READER SERVICE CARD: INDICATE A-11-170

ation. They also can be designed into equipment to provide impact resistance, to maintain precise leveling or to expedite servicing and maintenance on overhead cranes and other equipment.

Jack shown has a 15-ton capacity and travel to suit requirements. The housing is 8 $\frac{1}{8}$  in. long, 7 $\frac{1}{8}$  in. wide, and 8 $\frac{3}{4}$  in.



high; worm gear ratio is 8:1, with 32 revolutions of the worm giving one inch of travel.

Power source can be either manual or motor with reducer unit. Four-way miter box assemblies are available for multiple systems requiring synchronization.

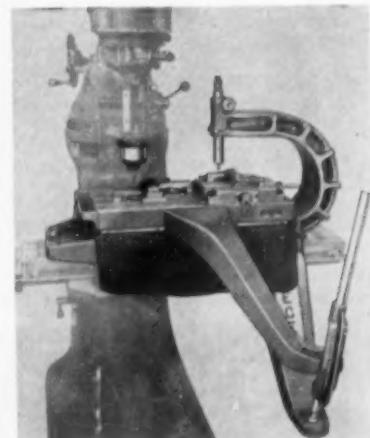
Jack Div., The Joyce-Cridland Co., 2027 E. First St., Dayton 3, Ohio.

**T-11-29**

### Two Dimensional Duplicator

Model R-200 duplicator facilitates fast, exact two dimensional contour profiling on any vertical miller.

The self-contained unit mounts on



**The Tool Engineer**

any table by tightening only 4 bolts, and combines sensitivity of fluid motion with rigidity provided by a base-casting-mounted follower arm. Machine is controlled by a single lever.

It has an adjustable built-in friction brake, strong enough for top-capacity profiling jobs. Free-moving table is float-mounted. Capacity of the duplicator is 6 x 6 in. with a 1 to 1 ratio with the master.

J. M. Kalins Co., 1575 Railroad Ave., Bridgeport, Conn.

T-11-30

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Contour Projector

A flat staging table for production-line optical gaging and a movable worktable for horizontal toolroom measurements provide an interchangeable table system for the Kodak contour projector, Model 14-6.

The flat 13 x 19 5/8-in. staging table embodies an 8-in. working distance at all magnifications, optimum screen and surface illumination, good definition and correction for distortion, and simple coordination between chart and fix-



ture. The projector is capable of providing accurate, speedy and economical handling of variety of parts.

The movable worktable replaces the flat staging table to make rapid horizontal measurement to 0.0002-in. possible. Slotted 19 1/4 x 8-in. worktable permits use of standard fixtures for simplified staging.

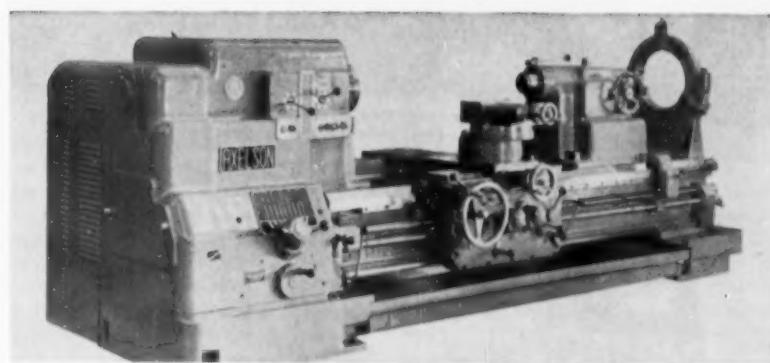
Distributed by Optical Gaging Products, Inc., 26 Forbes St., Rochester 11, N. Y.

T-11-31

## Lathe

Model 4431 lathe swings 44 in. over the ways and 31 in. over the cross slide. It is equipped with a 75 hp motor capable of developing over 100 hp for peak load requirements.

Headstock controls provide a range



of spindle speeds from 7 to 650 rpm in true geometric progression. The tailstock, which is a one-piece casting to assure maximum strength, has a two-

speed spindle. This provides a rapid rate for setting the center and a slow movement for drilling, boring, etc. The totally enclosed gearbox provides 61

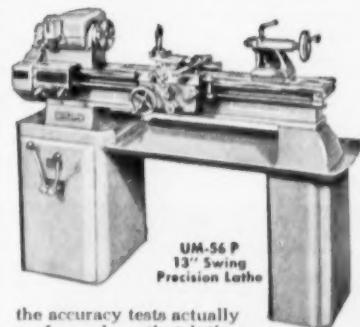
# SHELDON Precision LATHES

## for the size Lathes You Need Most

Sheldon lathes are built in the sizes you need most, for toolroom and production jobs. They are available with swings of 10", 11" and 13" . . . in varying bed lengths with 18" to 48" center distances . . . and . . . in your choice of pedestal, cabinet or bench mountings.

Powerful, all-V-belt, drive units—either the standard 8-speed (or 16-speed) E-drive; or the production favorite, a rapid, lever-shift U-drive. Where higher spindle speeds are desired, the standard E-drive can be built to provide speeds up to 2,000 r.p.m.

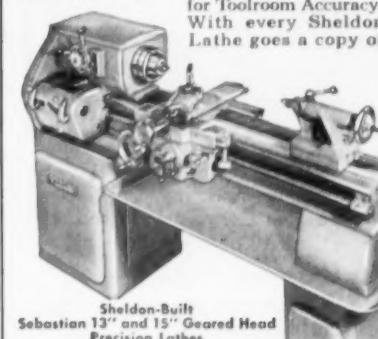
All Sheldon Lathes have hand scraped, built-in precision. Each lathe is guaranteed to meet or surpass the American Standards for Toolroom Accuracy. With every Sheldon Lathe goes a copy of



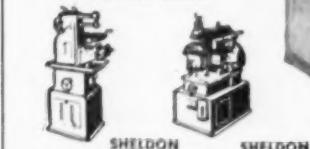
the accuracy tests actually performed on that lathe.  
(19 checks).

Important optional features include: hardened bed ways, L-00 Long Taper Key Drive spindles, 4" DI Camlock spindles, bed turrets, taper attachments and a complete line of toolroom and production accessories.

The new Sheldon-built Sebastian Geared Head Lathes have greatly increased work capacity and many advanced features. These include a wide, heavy, hardened and ground bed . . . easy shifting spindle speed dial . . . 60-pitch gear box . . . independent drop lever apron clutches . . . cam-action tailstock clamp . . . and, automatic lubrication in the headstock and apron with "1-shot" lubrication of carriage.



Sheldon-Built  
Sebastian 13" and 15" Geared Head  
Precision Lathes



SHELDON MACHINE CO., Inc.

Send in coupon or write for catalogs and names  
of nearest Sheldon and Sebastian Distributors  
where you can see these new lathes in operation.

SHELDON MACHINE CO., Inc.  
4224 North Knox Avenue, Chicago 41, Illinois

Gentlemen: Please send new catalogs describing:  
 Sheldon  10",  11"  13" Lathes  
 Sebastian 13" and 15" Geared Head Lathes  
 Horizontal Milling Machine  Name of Local Dealer  
 Sheldon 12" Shaper  Have representative call.

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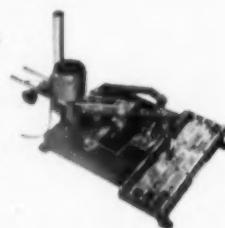
- Spindle speeds up to 26,000 rpm to engrave or for machining modern materials
- Fastest possible copy set-up
- Greatest ease and speed of adjustments
- Cutter grinders, rotary tables, master letters, compound slides, name plate blanks and all required accessories

### MODEL D2 HEAVY-DUTY 2-DIMENSIONAL

- 575 pounds rigid, sturdy, precise
- Micrometer adjustment for depth of cut
- Vertical adjustment of copy table automatic with Pantograph
- Ball bearing construction throughout — super precision ball bearings in spindle
- Unobstructed on three sides to take large work
- Ratios 2 to 1 to infinity — master copy area 26" x 10"

### MODEL 106 PORTABLE BENCH MODEL-2-OR 3-DIMENSIONAL

- 40 pounds of unbeatable speed and accuracy at a reasonable price
- Perfect for all machining applications within its range
- Ball bearing spindle has three speeds up to 14,000 rpm
- 5 positive, accurate pantograph ratios
- One copy carrier (supplied) accepts all master sizes
- Height of pantograph and position cutter are continuously adjustable
- Work up to 10" by any width
- Taper shank cutters



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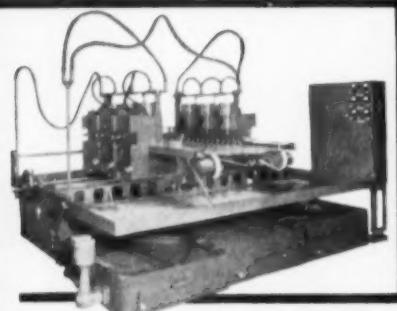
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Illustrated is a Sun Glass Grinding Machine made by Sun Tool & Machine Co. and equipped with a Gusher Coolant Pump.

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**Ruthman**

feeds and 45 leads.

Cast steel compound is capable of extended travel. Apron is extra heavy box-type design, completely enclosed so all shafts and gears operate with automatic pressure lubricant.

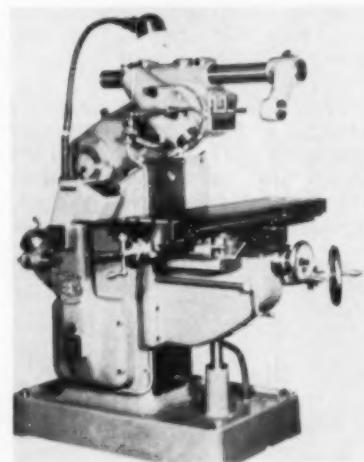
Axelson Mfg. Co., Div., U. S. Industries, Inc., 6160 S. Boyle Ave., Los Angeles 58, Calif.

T-11-32

## Vertical-Horizontal Miller

The Model VHF-2B combined vertical horizontal milling machine, called the Abene, offers 12 spindle speeds from 50 to 1300 rpm. Table size is 40 x 10 1/4 in.

The spindle can be placed at right angle with the longitudinal line of the table, and is adjustable for any angle, from 0 deg in the horizontal plane to 45 deg over the vertical plane. Because



of the slanting form of the top of the frame, the spindle nose retains the same long distance from the table in both horizontal and vertical positions.

The spindle is mounted in adjustable roller bearings. Gears of the gear box run in oil, the shafts there also being mounted in roller bearings.

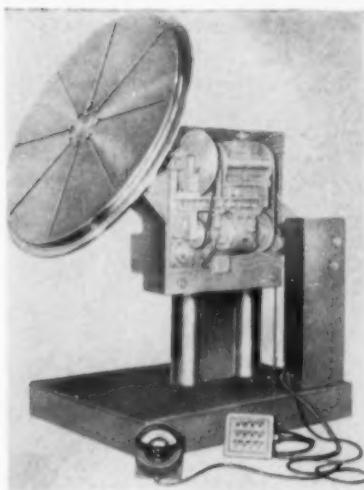
Standard machines are provided with No. 4 N.S.T. tapers.

Distributed by Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.

T-11-33

## Automatic Positioner for Titanium Welding

Model 21TS automatic positioner designed to meet the needs of precision production processes for welding titanium, provides a gas-tight seal plate under the 60-in.-round, 8-slot, precision machined table. The seal plate is 64 in. in diameter and allows a plastic gas-tight dome to be placed over table and workpiece to weld in gaseous atmos-

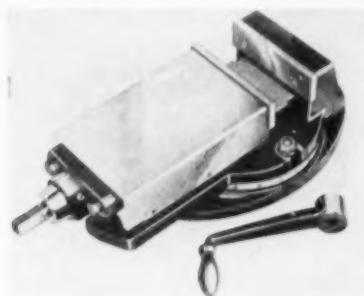


phere. It has precision controlled rotation at adjustable speed and fast positioning, powered tilting and powered elevating, all preset in an electrical panel. An electric tachometer with a 7-in. dial, accurate to 2 percent, reads rpm table speed setting of transmission so that weld speed can be preset.

Aronson Machine Co., Arcade, N. Y.  
T-11-34

### Machine Vises

Two Hylo precision machine vises in incorporating two-speed closing and gripping traverse are available in five sizes with open-jaw capacities ranging from 2 to 12½ in. Compact differential feed mechanism permits a tremendous grip-



ping torque without sacrificing speed of traverse.

Open-jaw capacities of the 6, 8 and 12 in. models are equal to the width of the jaws.

Utilizing two threads of different pitch on the same shaft, a single revolution of the drop-forged handle will open or close the hardened jaws at the high-speed traverse rate of ½ ipr. Low speed traverse rate of only ¼ ipr is automatically engaged immediately when the jaws contact the workpiece.

Accurately machined 60-deg V-ways prevent lifting and tilting of the jaws

and workpiece. The massive top jaw provides an accurate indicating surface and serves as a shield against chips entering the screw mechanism.

The twin-jaw heavy duty model features two-speed traverse in each of the two independent jaws and combines low mounting height with 12½ in. capacity for large milling, shaping and planing operation. The two independent jaws facilitate the holding of workpieces with unequal lengths of widths.

Redbow Precision Tool Co., 1113 W. Lawn Ave., Racine, Wis. T-11-35

### Radial Drilling Machine

Ram-type radial drilling machine can drill holes up to 18 in. in depth. With a compound angle attachment, holes on any compound angle also can be drilled by rotating drill head in two planes.

Automatic drill ejector permits quick tool changes while conversion to a semi-automatic tapping machine can be accomplished quickly.

Machine has a drilling area of 14.8 sq ft and handles workpieces higher than 4 ft high and more than 4 ft in

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diameter. The drill head can be brought to within 5 in. of the column or moved out to drill to center of a 52-in. circle. Distance from spindle nose to workpiece can be varied from 3½ to 52 in. The 20 x 28-in. table has coolant trough and three ½-in. T-slots.

Complete ram and head assembly rotates on the column 360 deg. Elevation of the column, which has a vertical movement of 12-in., can be accomplished either by hand crank or by a power unit.

Completely gear driven drill head provides spindle speeds from 78 to 1200 rpm and allows speed selection while machine is running. Drills up to 13/4 in. in diameter can be used.

The I. O. Johansson Co., 7248 St. Louis Ave., Skokie, Ill. **T-11-36**



## The only HARDENED & GROUNDED SWIVEL MILLING MACHINE VISE

No Pedestal

### OPERATOR WILL NOT HAMMER HANDLE

The J&S CLAMPCUT Milling Vise multiplies the clamping and holding power expected of a milling machine vise. The adjustable jaw head and positive down-holding clamping action gives multiplied pressure.

#### VERSATILE

- Holds out of square and out of parallel rough work pieces
- Adjustable VEE for holding rounds
- Rough work is held vertically

#### ACCURATE

- Powerful vise allows high accuracy for repetitive positioning
- Adjustable features permit faster better machining
- Mill .0005" parallel, or better

#### FASTER, EASIER TO OPERATE

- Larger opening
- Adjustable and deburring snap-on parallels
- Trigger opening and closing
- Coolant return trays
- Half the weight of standard vises, yet has twice the opening

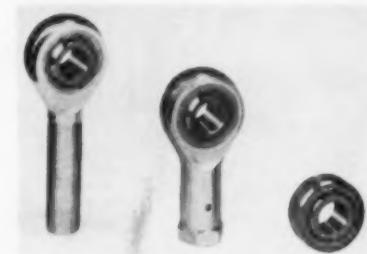
#### Distributors in Principal Cities



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## Self Lubricating Bearing

This self aligning, self lubricating bearing, marketed under the trade name of Fabroid, is a composite structure consisting of two fused layers. The bearing face is a weave of Teflon fibers interwoven on the back with glass fibers. The back-up layer is a weave of glass fibers impregnated with thermo-setting



resin. Because of that construction principle, the bearings are able to support static loads of up to 60,000 psi.

Micro-Precision Div., Micromatic Hone Corp., 2205 Lee St., Evanston, Ill. **T-11-37**

## Roughness Measurer for Profiling

Type PE rotary table Pilotor, provides circular tracing motion needed to measure surface roughness of concentric diameters on flat surfaces. Speed of the easy-to-load unit is adjustable through a control knob graduated in 1/16 in. to provide convenient means



for setting diameter of the trace. The tracer can be raised or lowered according to thickness of part to be measured. Standard range of the tool covers 3/8 to 2 in. radius.

Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich. **T-11-38**

## Automatic Turret Lathe

High-speed automatic turret lathe, designated Model 8-U, is designed for production of heavy components.

It has a 40-in. diameter swing over bed ways, chuck sizes to 30 in. and a 50 hp motor.

The large, heavy-duty automatic tur-

**The Tool Engineer**

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Literature Number	COMPANY	DESCRIPTION
A-11-222	Allegheny Ludlum Steel Corp. ....	Die Steel—Blue Sheet contains engineering data on B-47 die steel. (Page 222)
A-11-50	The American Brass Co. ....	Copper—Engineering specifications on Anaconda Tellurium Copper contained in Publication B-3. (Page 55)
A-11-239	American Instrument Co., Inc. ....	Instruments—Instruments for measuring coating thicknesses contained in Bulletin 2253-H-2. (Page 239)
A-11-42	Ampco Metal, Inc. ....	Nonferrous Materials—Bulletin 33 contains facts on "the metal without an equal." (Page 42)
A-11-198	Armstrong-Blum Mfg. Co. ....	Saws—Marvel catalog gives data on metal-cutting saws. (Page 198)
A-11-213	The Atrax Co. ....	Cutting Tools—Catalog contains standard reference on solid carbide tools and case histories. (Page 213)
A-11-243	E. W. Bliss Co. Die Supply Div. ....	Die Supplies—Line of die maker's supplies described in Catalog 70-A. (Page 243)
A-11-218	Brown & Sharpe Mfg. Co. ....	Milling Cutters—B & S catalog shows over 2300 high-speed steel tools and accessories. (Page 218)
A-11-280-3	Carr Lane Mfg. Co. ....	Construction Balls—Catalog 5 describes industrial uses of construction balls. (Page 280)
A-11-267	The Challenge Machinery Co. ....	Measuring Equipment—Catalog 838W contains data on Challenge Precision Surface Equipment. (Page 267)
A-11-224-2	Chaso Tool Co., Inc. ....	Cutting Tools—Cutting and chasing threads described in catalog. (Page 224)
A-11-35	Cincinnati Bickford Division Giddings & Lewis Machine Tool Co. ....	Radial Drills—Super Service radials described in Bulletin No. R-35. (Pages 24-25)
A-11-27	Clearing Machine Corp. Div. of U. S. Industries, Inc. ....	Presses—OBI Transflex described in bulletin. (Pages 26-27)
A-11-278	Denison Engineering Div. American Brake Shoe Co. ....	Presses—Catalog MUL-4 describes in detail the operations of Multipress. (Page 278)
A-11-319	Ehrhardt Tool & Machine Co. ....	Machining Products—"Triple plus" describes Ehrhardt's "Profit by Precision." (Page 319)
A-11-160	Speedgrip Chuck Div. Ernest, Holdeman & Collet, Inc. ....	Locators—Speedgrip expanding locators described in Bulletin #24. (Page 160)
A-11-15	Federal Products Corp. ....	Measurement—Catalog 55G shows complete line of dial indicator gages. (Pages 14-15)
A-11-50	Firth Sterling Inc. ....	Cutting Tools—Engineering details contained in catalog MTI-e "The Modern Approach to Economical Carbide Tooling." (Page 50)
A-11-290	The Foote-Burt Co. ....	Grinders—Circular No. 13A describes accurate grinding for small parts. (Page 290)
A-11-294	Galland-Henning Nopak Div. ....	Cylinders—Catalog SW-3 describes Nopak valves and cylinders. (Page 294)
A-11-264	George Gorton Machine Co. ....	Milling Machines—Gorton Mastermill described in Bulletin 2699-A-2611. (Page 264)
A-11-274	Handy & Harman. ....	Brazing—Bulletin 20 contains concise introduction to silver alloyed brazing. (Page 274)
A-11-202	Hannifin Corp. ....	Cylinders—Bulletin 150 tells the story of Hannifin "Hy-Power" hydraulics. (Page 202)
A-11-IFC	The Heald Machine Co. ....	Grinders—Heald Model 361 Rotary described in Bulletin 2-361-1. (Inside Front Cover)

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A-11-258	The Lincoln Electric Co.	Welding—Bulletin SB-1355 gives details on Lincolnweld. (Page 258)
A-11-63	Macklin Co.	Grinding Wheels—V-8 literature and wheel recommendations described in catalog. (Page 63)
A-11-168	McCrosky Tool Corp.	Cutting Tools—New series 900 milling cutters for milling with throw-away carbide inserts described in Bulletin No. 572. (Page 168)
A-11-298	Metal Carbides Corp.	Cutting Tools—Die Steel—Catalog 56-G contains data on Talide metal carbides. (Page 298)
A-11-21	Moteh & Merryweather Machinery Co.	Saws—Pocket-size guide to sawing operations contained in M & M Circular sawing handbook. (Page 21)
A-11-87	National Acme Co.	Chucking—Acme-Gridley chucking automatic described in Bulletins CM-44 and CM-51A. (Page 87)
A-11-45	Niagara Machine & Tool Works	Presses—Bulletin 64 describes Niagara double crank straight side presses. (Pages 44-45)
A-11-200	The A. H. Nilson Machine Co.	Special Machines—Nilson Vertiform, 4-slide forming on vertical machine, described in catalog. (Page 200)
A-11-62	Pines Engineering Co., Inc.	Special Machine—Booklets contain data on case histories of production bending. (Page 62)
A-11-9	Pope Machinery Corp.	Machine Attachments—Bulletin WA-10 gives information and specifications on wheel holders, extension arbors and collet chucks. (Page 9)
A-11-150-2	Ruthman Machinery Co.	Pumps—Catalog contains engineering applications of Ruthman Gushee coolant pumps. (Page 150)
A-11-158	Sandvik Steel, Inc.	Carbide Tools—Coromant S-6 described in catalog and tooling guide. (Page 158)
A-11-208	Seibert & Sons, Inc.	Special Tools—Brochure describes Seibert's line of holding and driving tools. (Page 208)
A-11-238	The Skinner Chuck Co.	Chucks—Catalog No. 68P gives details of all Skinner chucks and fixtures. (Page 238)
A-11-36	The L. S. Starrett Co.	Measurement—Catalog No. 27 shows complete Starrett line for precision measurement. (Page 36)
A-11-66	U. S. Tool Co., Inc.	Press Equipment—Bulletin 80T and 95-T contain detailed information on U S pressroom equipment. (Page 66)
A-11-272-2	The Vaill Engineering Co.	Special Machines—Bulletin T-1 describes Vaill tube end-forming machines. (Page 272)
A-11-154	Vascoloy-Ramet Corp.	Carbides—Catalog gives details on V-R carbide grades for milling cutter tips, as well as for all general machining applications. (Page 154)
A-11-32	Vlier Engineering Inc.	Fixture Components—Catalog lists accessories for machine and fixture design. (Page 32)
A-11-164	Wales Strippit Co.	Die Supplies—Bulletin No. 26K describes Wales Strippit's die production. (Page 164)
A-11-150	Wallace Supplies Mfg. Co.	Special Machines—Bending and cut machining units described in catalogs. (Page 150)
A-11-52	Wiedemann Machine Co.	Punch Presses—Bulletin 201 describes quick-change tool for punch presses. (Page 52)

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ret lathe offers extra speed and power needed to remove tough alloys fast and has extra capacity and strength required to produce large, heavy components quickly and accurately on a fully automatic cycle basis.

The Model 8-U is constructed with a heavy steel weldment base. It has four automatic speed changes and three automatic feed changes for each set of pick-off gears. All slide and spindle motions are controlled from a centralized push-button panel.

Potter & Johnston Co., Pawtucket, R. I. **T-11-39**

### Air Gaging Spindles

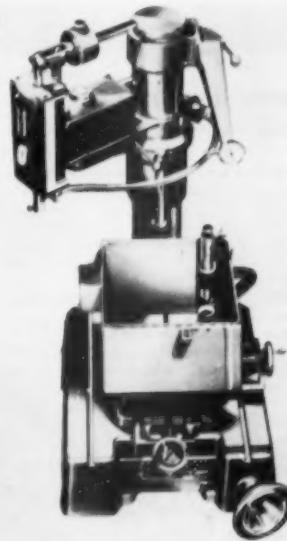
These light weight, low cost air gaging spindles are constructed so that they change color as a result of wear. Thus spindle condition is easily judged and the plug rotated to increase wear life.

The spindles, called Hardcoat Plugs, are made of aluminum with recessed nozzles. Wear surfaces are unusually hard as a result of a special electrolytic process.

Moore Products Co., H & Lycoming Sts., Philadelphia 24, Pa. **T-11-40**

### Electrical Discharge Machine

Intricate precise outlines and contours can be cut through or sunk into hardened metal with the Mark III Sparcotron electrical discharge machine. The electrode is held in a chuck in the machine head and is automatically lowered into the dielectric bath leaving a minute gap between it and the work surface. The gap is maintained continuously by a servo control on the head. A pump circulates the dielectric be-



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CHICOPEE, MASS.  
INDICATE A-11-177

## Accurate, Rapid Countersink Gaging!

### TRULOK Countersink GAGE

This gage is an accurate high-precision instrument which requires no special skill or technique to use. The scale reading is direct with large .005" divisions, can easily be read within .001" tolerance. Made of HSS, in satin finish.



Set includes Calibration Block and handy Contour Gage for monitoring countersink drilling.

The TRULOK is manufactured by TRIO PRODUCTS exclusively for

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Trulok set is packaged in handsome, rugged, lined case.

#### National Distributors

**E. H. STAU CO.**  
351 S. Atlantic Blvd., Los Angeles, Cal.  
AN. 3-3877

tween the table tank and a tank in the machine base to remove particles of eroded metal from the work and electrode as fast as they are formed.

Head stroke is maximum of 3 in. for each setting. The machine table will take a 500-lb load. The head swings to one side on the 5-in. machine column to clear the 20 by 13 in. table tank for work change.

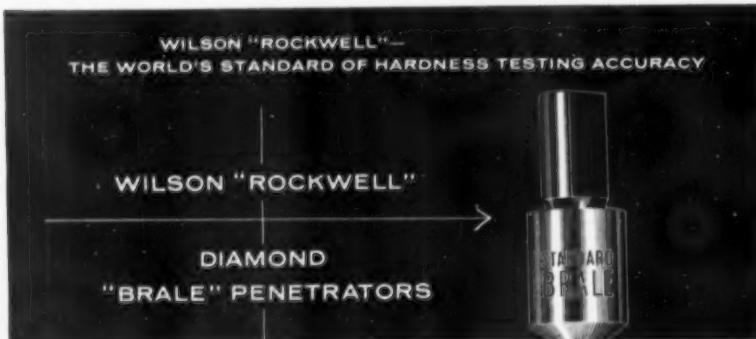
Control can be manual or automatic. One to four machines can be operated from one main control power unit which is enclosed in a separate control cabinet. Both main and auxiliary units can be operated independently. An auxiliary control cabinet is designed to operate at maximum power of the main control cabinet, which has been increased to 6.5 kw. Because microswitches are located at all strategic positions, the machines can be left unattended until the operation cycle is completed.

Easco Products, P. O. Box 587, Ypsilanti, Mich.

**T-11-41**

### Boring Mill

Electrically controlled vertical boring and turning machine is equipped with adjustable stops for vertical and horizontal feed control of all heads. For standard five-position turret head, one vertical adjustable stop is provided for each of the five turret faces. For



#### Your hardness testing is no better than the penetrator

A FULL WILSON LINE  
TO MEET EVERY HARDNESS  
TESTING REQUIREMENT

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Every WILSON Diamond "BRALE" Penetrator  
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MECHANICAL INSTRUMENT DIVISION  
AMERICAN CHAIN & CABLE

230-H Park Avenue, New York 17, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-178-2



horizontal travel of the saddle, five adjustable stops are provided.

In addition to automatic stops, other optional additions to the machine include automatic tracing control of heads, automatic cycling, power indexing of turrets, and constant surface cutting.

The machines are designed to provide high production rates, accurate work, and simplified maintenance. All controls are located for maximum operator

**The Tool Engineer**

convenience. Two horsepowers are provided on each machine: 40 and 50 hp on 30, 36, and 46-in. sizes, 75 and 100 hp on sizes 56 in. and up.

Feed and speed range provides 24 feeds from 0.0016 to 0.250 per table revolution, and 24 speeds in any one of three standard ranges: low, intermediate, or high. Both feed and speed selection are preselective from direct-reading dials.

American Steel Foundries, King Machine Tool Div., 1150-Z Tennessee Ave., Cincinnati 29, Ohio.

**T-11-42**

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

### Toolholder

Adjustable toolholder for turret lathes is engineered to insure true center precision drilling, reaming, and tapping operations. The holder is designed for quick, easy positioning of tools and to compensate for as much as  $\frac{1}{32}$ -in. misalignment. Dead center settings are made by simply adjusting positioning set screws and tightening locking cap screws. The holder simpli-



fies setups, saves time, and minimizes tool wear and breakage, and scrap losses.

Shank and holder are precision machined concentric within 0.0005 in. Danger of cocking is eliminated and bell-mouthed, out-of-round, tapered, and oversized holes are prevented.

Four standard holders are provided in bore and shank diameters of  $\frac{3}{4}$ , 1,  $1\frac{1}{2}$  and  $1\frac{3}{4}$  in.

Rockford Engineered Products, Inc., Rockford, Ill.

**T-11-43**

### Hydraulic Stretcher

This 300-ton hydraulic stretcher, for straightening and detwisting extrusions, will accommodate extrusions from 5 ft to 50 ft long. The machine which is 9 ft in over-all length, has a head and tailstock range from  $9\frac{1}{2}$  to 17 in. Hydraulic system operates at 2550 psi with a take-up speed of 520 ipm, a stretching speed of 141 ipm, and a return speed of 885 ipm. Pumps are equipped with DY control.

Four-way jaws mounted in the rotat-

## shamrock

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for  
automatic  
screw machines*



Shamrock, a water-soluble chemical emulsion combining good cooling and extreme-pressure lubricating properties, is giving excellent service in single and multiple spindle automatic screw machines. It is also widely used when machining at moderate feeds and speeds for broaching, threading and tapping, as well as for drawing and stamping. It contains no sulfur or chlorine commonly used as extreme pressure additives, and it completely eliminates all smoke nuisance as well as the dermatitis problem. Shamrock helps keep any shop clean.

### RESULTS THAT COUNT

Using Shamrock 5 to 1 a prominent Illinois manufacturer (name on request) increased tool life approximately  $2\frac{1}{2}$  times and entirely eliminated the smoke nuisance from the following operation: The work was drilling and tapping railway track and switch controls, the material 1020 and 1040 hot rolled steel, the speed 170 RPM, 50 RPM faster than possible with the previous coolant.

*Send for  
descriptive  
literature.*



**F. E. ANDERSON OIL COMPANY INC.**

BOX 213 PORTLAND, CONNECTICUT

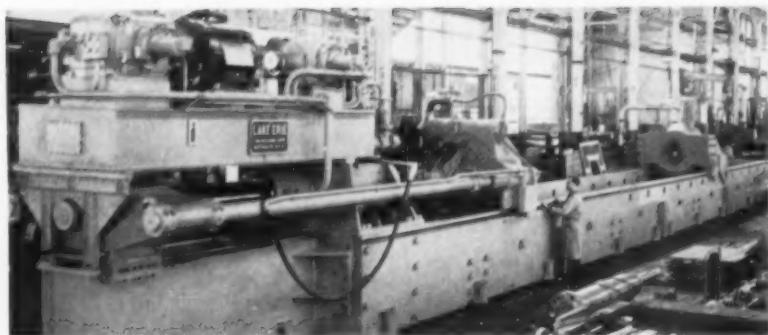
Branch Offices in Chicago, Detroit and Los Angeles  
Distributors in other principal cities

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-179

ing head are actuated by pneumatic cylinders through a rack and gear arrangement. One cylinder actuates two vertical jaws simultaneously while separate cylinders operate two side jaws independently.

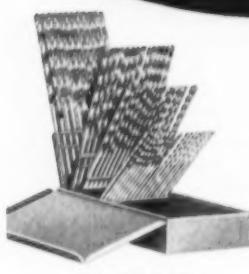
The detwist head is constructed so that it permits unlimited detwisting of the extrusion. Shock absorbant devices on the jaw holders protect stretcher components in event of extrusion rupture.

In addition to the travelbeam bridge type crane, there is a conveyor system



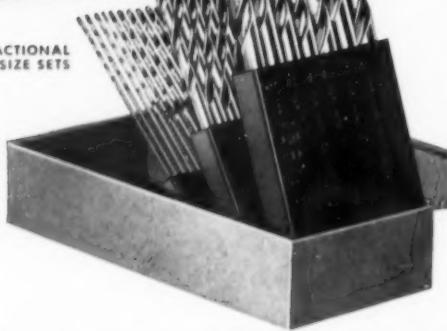
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Hardened H.S.S. Blanks  
General Purpose Drills

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Heavy Duty Drills  
Slow Spiral Drills  
Fast Spiral Drills

"Hi-Brinell" Drills  
Solid Carbide Drills  
Taper Shank Drills  
Chuck Reamers

Carbide Tipped Drills  
Step & Subland Drills  
"L" & "M" Plastic Drills  
Drill Length Reamers

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-180

combined with loading and unloading tables.

Lake Erie Machinery Corp., 705 Woodward Ave., Buffalo, N. Y.

**T-11-44**

### Power Blades

These power hack saw blades, called the Guillotine DuWeld Pro-Set blades, have long blade life and high cutting speed because of the construction of progressive tooth setting. Tooth and gullet capacities are identical in size, but the amount of set is increased in infinite degrees from starting to finishing ends of the blade.

This design reduces initial impact at the start of cutting stroke approximately 50 percent. Metal is gradually and smoothly displaced, reducing chip load per tooth and increasing blade life. Progressive cutting action is constant regardless of size of workpiece. The shatter-proof blades are die set for accuracy, and individually heat treated for uniform hardness of entire cutting edge.

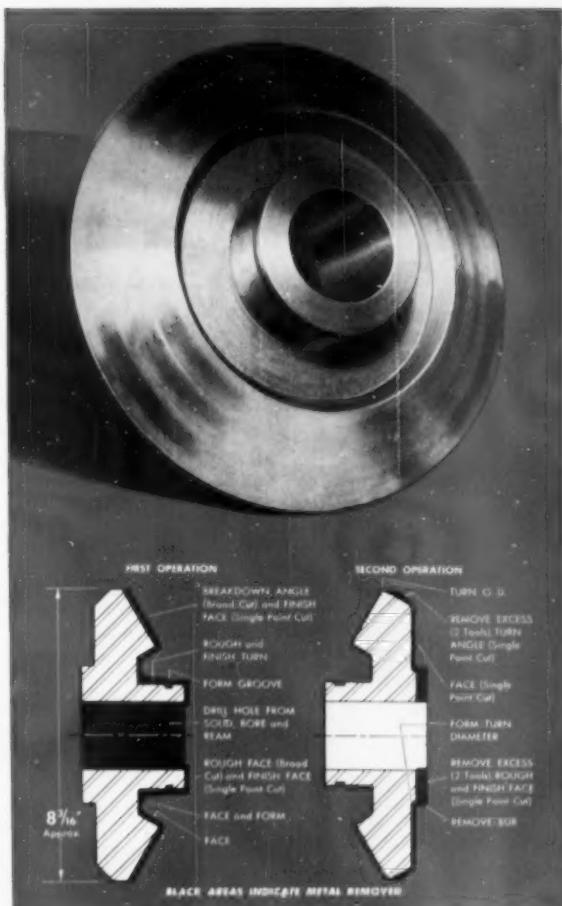
The E. H. Wachs Co., 1525 N. Dayton St., Chicago 22, Ill. **T-11-45**

### Welding Blowpipe

The medium pressure Oxweld W-47 welding blowpipe is capable of welding any metal thickness from 28 ga to 3 in. and handling heating jobs requiring total fuel gas flows up to 1500 cu ft per hour. It handles any oxygen or acetylene flow from 2 to 300 cu ft per hour. It is provided with a broad selection of welding and heating heads, extensions, and accessories.

A simple change of welding heads quickly converts the blowpipe from light-duty welding and brazing to heavy-duty welding or heating. A convenient cutting attachment equips the blowpipe for flame cutting on metal up to 8 in. thick.

Each of the 42 welding and heating heads available for use with the W-47 has an individual cartridge type mixer that provides thorough mixing and proportioning of gas, thus assuring soft



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how one of our  
P & J Automatics*



*put this*

## "PROBLEM" Job on a PAYING BASIS!

Some of the toughest machining jobs you'll ever have to handle get that way, *not* because of any *single* factor like extra-hard metal or really heavy cutting, but because of *several* contributing factors that can add up to a lot of machining time and a big profit loss. The job shown here . . . which one of our customers brought in recently . . . is a good example. A glance at the "Job Facts" will show you a combination of factors that could easily have made this job a real problem. The most difficult of these requirements was machining the bevels . . . which had to meet close tolerances for size and conformity to the true angle and, in addition, demanded a fine finish with no tool-return marks permitted. However, handling this part on a Potter & Johnston 4-U Automatic, with a tooling set-up engineered by P&J Tooling Specialists, put this potential headache on a high-output, high-profit basis.

A new P&J Automatic can put *your* problem jobs on a paying basis too! Send me your sample prints and I'll show you how a P&J Automatic with P&J Tooling can help you turn

### HERE ARE THE JOB FACTS:

**PART:** Bevel Gear

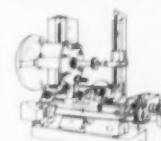
**MATERIAL:** Steel Forging, 190 Brinell

**MACHINING REQUIRED:** 22 separate roughing and finishing cuts including several hard-to-handle angle cuts.

**SPECIAL REQUIREMENTS:** Hold bevel angles to close tolerances and produce a good finish.

**RESULTS:** A part finished every 13 minutes floor-to-floor time . . . on a P&J 4-U Automatic!

out your toughest jobs faster, better and at lower cost. Write Potter & Johnston Company, Pawtucket, Rhode Island.

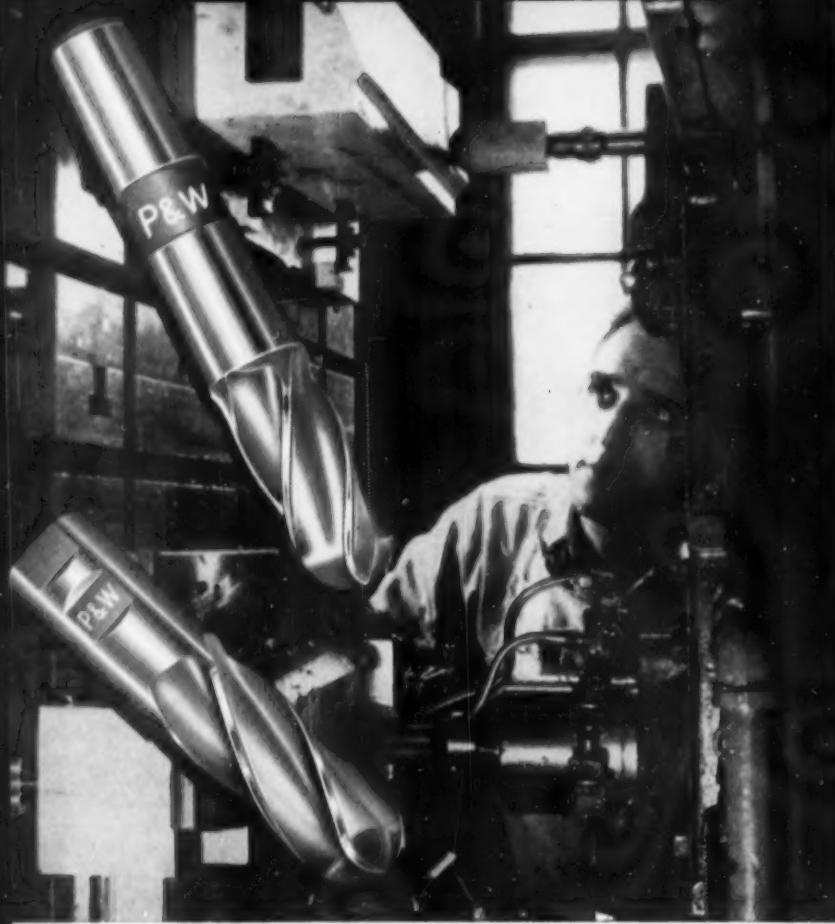


AUTOMATIC TURRET LATHES . . . GEAR CUTTERS . . . GILDA PACKAGING MACHINES



# POTTER & JOHNSTON

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PRECISION PRODUCTION TOOLING SINCE 1898



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. . . because PRATT & WHITNEY KELLER CUTTERS produce *more* accurately machined pieces per tool and run longer between grinds. The result is lower *tooling costs* than with other cutting tools which may cost less initially, but produce less. Correctly designed, precision manufactured from selected steels and inspected to meet rigidly high P&W standards, they are *quality* from start to finish! Now produced in both straight and taper shank types in a wide range of lengths and diameters. Available from stock at the P&W Branch Office near you.

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*Pratt & Whitney Company, Inc.,  
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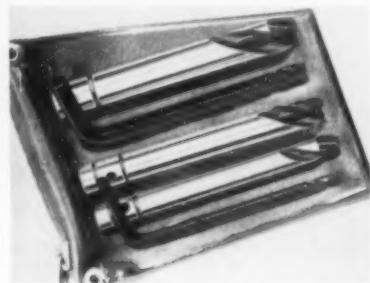
and stable welding flames. Flashback is prevented at all working pressures. Its construction is such that heat conduction to the handle and internal parts is retarded. Chrome plated welding heads resist adherence of slag and spatter.

Linde Co., Div., of Union Carbide Corp., 30 E. 42nd St., New York 17, N. Y.

**T-11-46**

## Twist Drill Extractor

Quick, sure withdrawal of broken twist drills from their holes is assured with this twist drill extractor. It is designed so that it is unnecessary to dis-



turb the jig or setup, and only normal hand pressure is required.

The standard set of 5 extractors includes  $\frac{5}{32}$  to 1 in. sizes, in a zippered plastic pouch. The tool also can be obtained individually in the other required sizes.

Eagle Metal & Tool Corp., 150 Broadway, New York 38, N. Y.

**T-11-47**

## Flexible Link Shaft

Designed to have equal torque in both directions, unlimited length and equal flexibility in all sizes from  $\frac{3}{8}$  to 3 in. diam, this flexible link shaft is suitable for remote controls and power drives.

Links consist of trunnion blocks and two half links fastened together with screws or rivets. Cover materials are available in a variety of materials including armored neoprene hose, non-metallic hose or semirigid tube. End fittings are available to meet specific requirements. Minimum link length is three times the diameter. Various link lengths can be combined in one shaft.

**The Tool Engineer**



using long links for straight runs.

Torque ratings for manual torsional movement are 50 in.-lb for  $\frac{3}{8}$  in. shaft; 200 in.-lb for  $\frac{1}{2}$ -in. shaft and 2500 in.-lb for  $1\frac{1}{4}$ -in. shaft. For motor drives at 1750 rpm,  $\frac{1}{8}$  in. hp requires  $\frac{3}{8}$ -in. shaft,  $\frac{1}{3}$  hp requires  $\frac{1}{2}$ -in. shaft and 1 hp requires  $\frac{3}{4}$ -in. shaft.

Clark Flexible Link Shaft Co., Box 73, Newton Highlands 61, Mass.

**T-11-48**

## Vises

This series of four drill press and milling machine vises requires no special jigs or fixtures. They are designed for complete interchangeability of parts from one vise to another of the same size. All working parts are replaceable.

Each vise has a vertical slot for holding rounds and base slots extend toward the front jaw to prevent damage from vertical drilling. A swivel crank



handle drops down out of the way, so it does not interfere with machining operations.

The vise bed is so designed as to clear heads of mounting bolts. Four  $1\frac{1}{4}$ -in. keyslots are spaced at right angles for precision location on the press or machine.

In the four units, widths of vise jaws range from  $3\frac{1}{2}$  to 5 in.; jaw depths from  $1\frac{1}{8}$  to 2 in., and jaw openings from  $4\frac{1}{2}$  to 6 in.

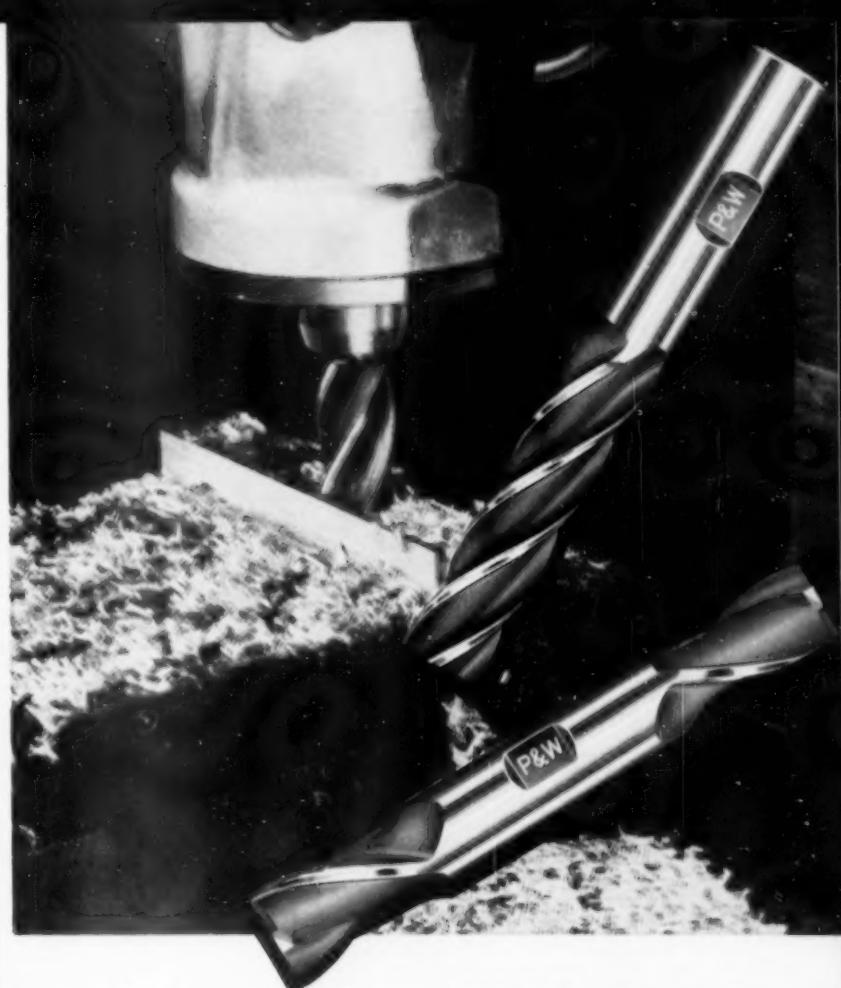
The Columbian Vise & Mfg. Co., 9018 Bessemer Ave., Cleveland 4, Ohio.

**T-11-49**

## Thread Cutting Lathe

This automatic cycle single point thread cutting lathe, designated the Man-Au-Cycle Hydro Magnetic, accomplishes fast thread cutting on long or short internal or external work. Features of the lathe include 32-in. threaded length, 0.0250 to 2.00 in. lead capacity, 13-in. diameter swing, and 2 in. hole through headstock.

Electromagnetic clutch and brake provides instantaneous stop and start. There also is an improved system for



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Send now for completely descriptive literature.

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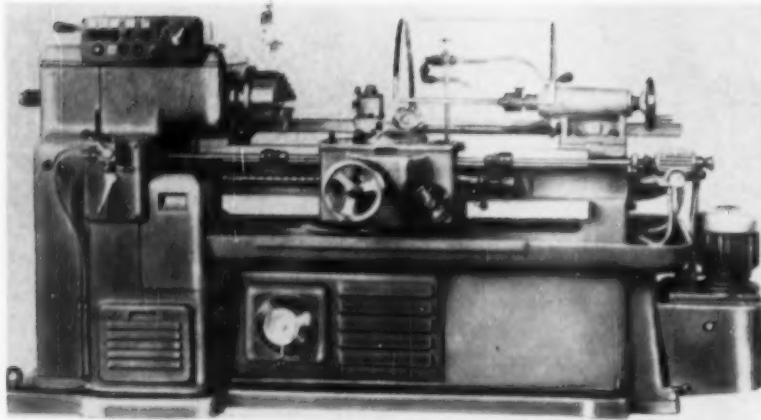
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multistart operation, a single control switch for start, stop and neutral positions, hydraulically controlled tool cycle, hydraulically controlled sine bar type taper attachment, hydraulic facing and cutoff attachment and hydraulic turning and tracing attachment. Air

chucking equipment includes pneumatic tailstock controls. The chuck is self-centering. Cutting speeds range to 400 lineal ipm.

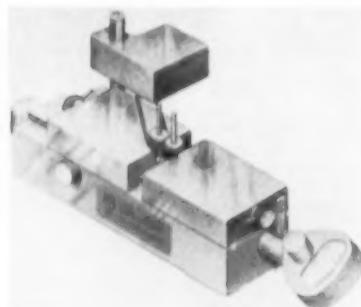
Man-Au-Cycle Corporation of America, 132-53rd St., Brooklyn, N. Y.

**T-11-50**

## Gear Checker

Gears up to 3-in. center distance can be accurately checked during production with this fine pitch gear rolling instrument thus permitting errors to be evaluated and corrected on the spot. Mikrokator dial of the tool give readings calibrated in 0.00002 in. An indicator calibrated in 0.00001 in. also is available.

The instrument which is designed to withstand production line use, is free



of excessive pressures; it has a low-inertia measuring slide and slide pressures are easily adjusted to fractions of an ounce. Constant direct motor drive assures absolute angular velocity. There is no risk of human error.

A complete line of accessories is available for checking worms and worm wheels, as well as spur, bevel and helical gears.

Machine and Instrument Div., of Illinois Tool Work, 2501 N. Keeler Ave., Chicago 39, Ill.

**T-11-51**

## Carbide Tools

Three recently developed carbide cutting tools include a chatterless single flute solid carbide countersink, a single flute solid carbide center lap and a chucking reamer.

The countersink is available in  $3\frac{1}{8}$ ,  $1\frac{1}{2}$  and  $\frac{3}{4}$  in. diam all with  $\frac{1}{4}$  in. shank with 80 deg taper. Standard 60 deg taper also is available by order. The solid carbide center laps are offered with 60 deg taper in the same sizes as the countersinks. Chucking reamers are available in  $1\frac{1}{4}$  to  $\frac{3}{4}$  in. sizes.

Super Tool Co., Sales Dept., 21650 Hoover Rd., Detroit 13, Mich. **T-11-52**

## Injection Molding Machine

A full clamp stroke with maximum tonnage this 8-oz plastics injection molding machine can operate at 720 cycles per hour. With reduced stroke, as many as 900 cycles per hour are possible. Model 200-H-6/8 is suitable for both high-speed jobs and for all types of difficult custom molding.

The machine has a 30 hp motor, which features a full hydraulic clamp with 15 in. stroke and 25 in. daylight. The clamp automatically adjusts for different mold thicknesses. Any part of the total ram stroke can be used. Clamp controls are centralized. Movable cams provide easy adjustment for stroke, daylight, slow-close for die contact, slow breakaway and ejection stroke.

Independent clamp and injection circuits allow simultaneous traversing of

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### VERO BEACH, Florida

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### WEST HARTFORD 1, Conn.

505 Oakwood Avenue

Tel: ADams 3-7561

### AGENTS:

#### DALLAS 35, Texas

Southwest Industrial Sales Co.

2526 W. Mockingbird Lane

#### HOUSTON 23, Texas

Tri-Tex Machine & Tool Co.

903 South Seventy-fifth

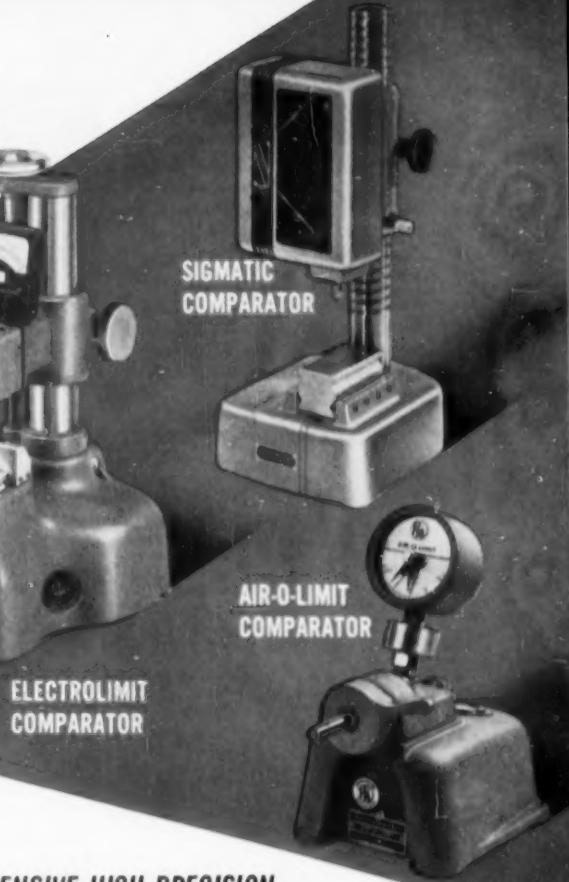


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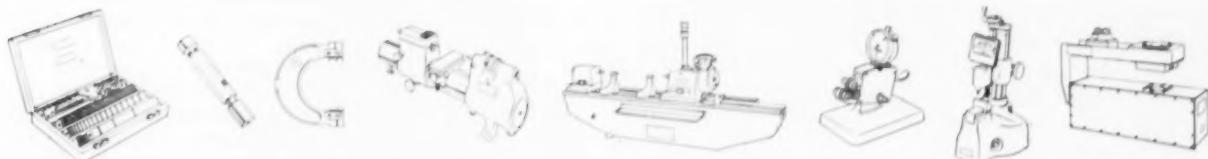
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for external gaging. P&W *Sigmatic* Comparators combine the simplicity of mechanical operation with magnifications up to 5000X. Easily portable, require no outside power source.

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**FOR MORE ACCURATE PRODUCTION . . .** a P&W *Supermicrometer* is ideal for daily use at the machine or inspection bench. Reads direct to .0001". Controlled measuring pressure eliminates operator's errors.



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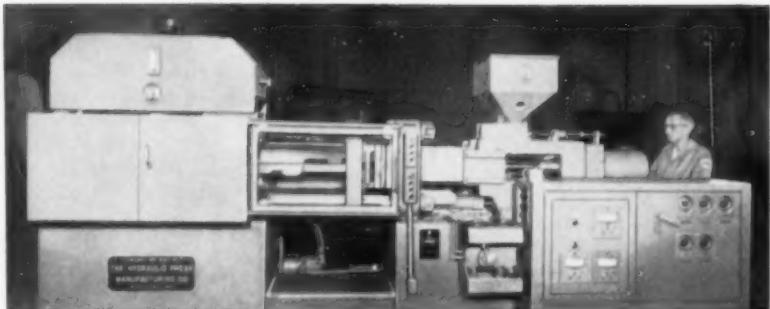


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both clamp and injection rams.

The injection circuit features: controls for prepacking for shots of 8 oz or more, flow control for plunger slowdown, dual pressure adjustment for low holding pressure after mold is filled, and automatic unloading of injection pump. The differential circuit allows rapid prepositioning of the injection plunger at the start of the cycle. Clamp pressure build-up then actuates the injection plunger for the "shot." The entire injection assembly is hydraulically



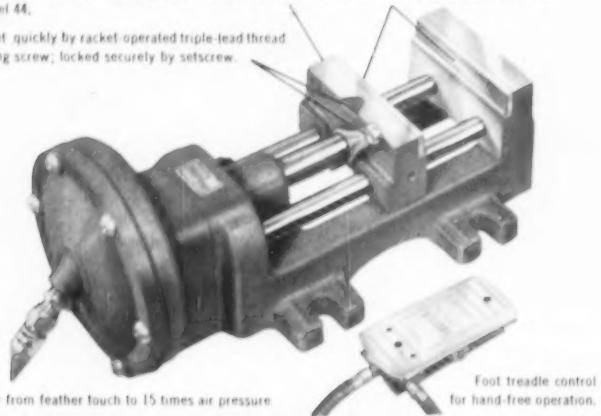
# **now heinrich** AIR VISES

## **IN TWO SIZES—3" or 4" JAW WIDTHS FOR HIGH-SPEED PRODUCTION**

Jaws adjustable to  $3\frac{1}{8}$ " opening on Model 33— $4\frac{1}{4}$ " on Model 44.

Jaws set quickly by racket-operated triple-lead thread adjusting screw; locked securely by setscrew.

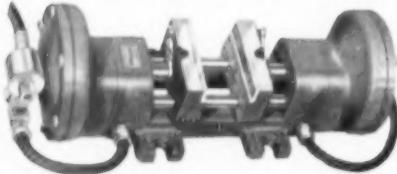
Built-in recessed parallels level work.



Holding power from feather touch to 15 times air pressure.

Foot treadle control for hand-free operation.

### **HEINRICH SELF-CENTERING AIR VISE**



Movement of jaws synchronized within a tolerance of  $.001$ " by gear and rack. 4" wide jaws adjustable to  $4\frac{1}{8}$ " opening, travel  $3\frac{1}{8}$ " each jaw; total  $3\frac{1}{4}$ ".

### **HEINRICH AIR CLAMP**

Eliminates bothersome hand clamping. Piston rod setting adjustable to  $3\frac{1}{8}$ ". Maximum travel  $3\frac{1}{8}$ ". Height  $6\frac{1}{8}$ ", width  $5\frac{1}{4}$ ".



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**heinrich**  
TOOLS, INC.  
DEPT. 187-L, RACINE, WIS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-11-186

actuated.

A separate pilot circuit has external pressure and pilot lines to each valve.

Platens 26 x 26 in. provide space to mount mold bases up to 15 x 26 in., either vertically or horizontally. The  $15\frac{1}{2}$  in. space between tie rods and the large area below the die space allows plenty of room for automatic drop-out of parts. The knock out bar exerts 15-ton pressure and has a 4-in. stroke. Automatic clamp slow-down is provided prior to bar contact to prevent damage to ejected parts.

The Hydraulic Press Mfg. Co., Div. of Koehring Co., Mount Gilead, Ohio.

**T-11-53**

USE READER SERVICE CARD ON PAGE  
175 TO REQUEST ADDITIONAL TOOLS  
OF TODAY INFORMATION

### **Jig Boring and Milling Machine**

The Hydroptic-6A jig boring and milling machine has an enclosed optical measuring system. Graduations on the standard scales incorporated in the worktable and spindle head saddle are magnified and viewed on built-in projection screens having micrometer drums with vernier readings to  $0.0001$  in. Reference scales, subdivided in ten lines per inch are read for approximate position. Castings and standard scales are made of materials with matched coefficient of thermal expansion.

Table movement is infinitely adjustable through hydraulic drive. Vertical travel of the movable crossrail is motorized and parallelism of the crossrail to the table top is assured.

Spindle head saddle is traversed by a motor which allows automatic milling feeds (in each direction) of  $1\frac{3}{8}$ ,  $2\frac{7}{8}$ ,  $4\frac{3}{8}$ ,  $8\frac{5}{8}$  ipm and a rapid power traverse of 60 ipm.

Spindle drive motor provides machining power for drilling, from the solid, holes  $2\frac{3}{8}$  in. in diameter in either cast iron or steel; for milling cuts  $4 \times \frac{1}{4}$  in. in cast iron with a feed rate up to 10 ipm, or milling cuts of  $4 \times \frac{3}{16}$  in. with a feed rate of  $8\frac{5}{8}$  in. diameter in steel.

Surface finishes do not exceed 4 or 5 microinches in mean roughness.

The spindle is assembled within a 5 1/4-in. diameter quill, which has 12-in. travel and power feed in both directions.

The spindle head has a preselector for 18 spindle speeds from 40 to 2000 rpm. Once the speed has been selected, it can be engaged at any time by a single lever. There is push-button spindle reverse rotation for tapping. The spindle head is equipped with a built-in depth measuring device with dial indicator reading to 0.0005 in.

An additional productive capacity of up to 30 percent is possible when the machine is arranged with the automatic coordinate repeating device, which is



added to the normal optical measuring system.

Automatic repetition of more than 20 positions is possible when two or more of the locations have a common axis. Settings will repeat indefinitely with an accuracy of 40 millionths of an inch.

Electronic control for the units, including a magnetic memory drum, is in a separate cabinet.

American SIP Corp., 100 E. 42nd St., New York 17, N. Y. **T-11-54**

### Arbor Support Bearings

A standard line of arbor support bearings is built on an anti-friction bearing design principle which utilizes an unusually large number of balls. The design also provides large bearing contact area, resulting in high load capacity.

A minimum of space is required to house the ball bearings, thus permitting a maximum ID. Low cost, easy-to-use arbor bearing collars are available for each standard bearing providing a wide range of interchangeability.

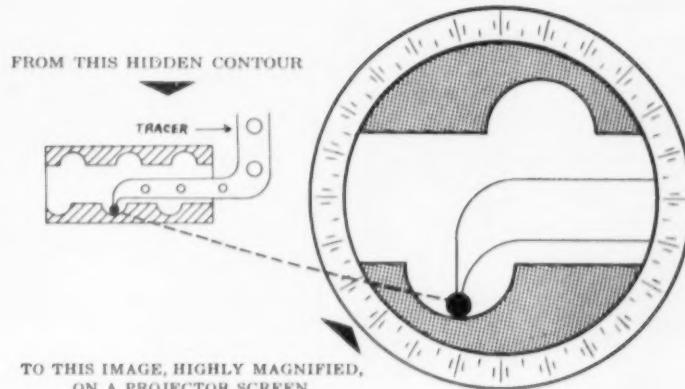
Seated completely within the arbor support housing, the bearing does not

## how to inspect internal contours or cam-like parts

IN MINUTES... NOT HOURS

### YOU DON'T PROJECT IT ... YOU TRACE IT!

with O.G.P. Projector Tracers



Many once difficult gaging jobs are now accomplished with ease and speed by O.G.P. Projector Tracers. It will inspect: 1. Special thread forms. 2. Cam contours. 3. Internal tapers. 4. Hole locations. 5. Milled slots. 6. Fillets. And many other part characteristics. Standard and custom-made models for most optical projectors.

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26 Forbes St., Rochester 11, N. Y.

Please send me complete data on how quickly and easily to inspect hidden contours and dimensions by means of O.G.P. Projector Tracers.

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#### OPTICAL GAGING PRODUCTS, INC.

#### SPECIALISTS IN PROJECTION GAGING

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on a  
**Rousselle**



**40-TON  
PRESSES**

Take job after job in stride and give you top speed and uniform output on a variety of work. They stress simplicity in every detail to achieve quicker set-ups, easier changeovers and simpler operation. All are extra rugged, high precision units, made to withstand hard usage and assure long, satisfactory service. They are very moderately priced.

Significant savings may result if you let our engineering staff assist you. There is no obligation.

Rousselle Presses are sold exclusively through leading machinery dealers.

Choice of 25 models in 5 to 40-ton sizes.

Manufacturers of Rousselle Presses

**SERVICE MACHINE CO.**  
2310 WEST 78th STREET  
CHICAGO 20, ILL.

INDICATE A-11-188

project into the work area. Arbor chatter and binding are minimized, making it possible to increase machine feeds and speeds.

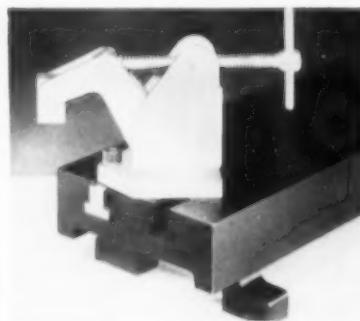
Bearings are available in 12 standard sizes to meet the needs of most makes of milling machines.

Briney Mfg. Co., P. O. Box 2208, Pontiac, Mich. **T-11-55**

**Clamp**

This No. 3 FCT lock clamp is designed to permit an operator to quickly clamp any shape or thickness up to 3 in. It may be used on any machine or fixture which has a T slot, and no adjustment is necessary.

The clamp, which is 4½ in. high, is



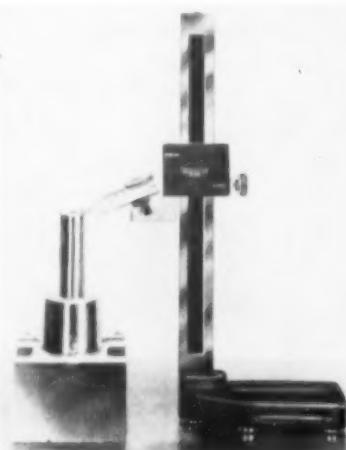
designed so that an immediate pressure up to 2000 lb can be applied without a wrench. Retraction is easy and immediate.

General Alliance Corp., 2105 Moore St., San Diego 1, Calif. **T-11-56**

**Height Gage**

This Check Master height gage, adjustable to 0.0001 inch accuracy, has a rigid 5 1/16 x 11 1/4 in. column supported by a solid cast iron base.

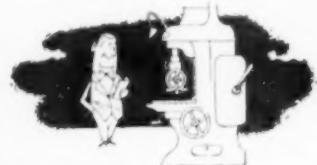
Desired height is easily set by a simple lift or press at point marked on



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**CONVENTION CENTER  
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**SEE** all the very latest advances and improvements in more than thirty major categories of industrial products.



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**INSPECT** the modern equipment and up-to-the minute manufacturing methods being utilized in booming Delaware Valley plants.



**AMERICAN SOCIETY  
TOOL SHOW CONFERENCE '58  
OF TOOL ENGINEERS**

the carriage. One-finger pressure will raise or lower carriage to approximate desired setting—final setting is then accomplished by turning fine adjustment screw at back next to the lift position.

Construction is designed to avoid error from air-cushion action.

As base does not protrude beyond the column, maximum clearance is assured for close positioning. Tight coupling of the gage also is provided so errors in indicator readings caused by overhang leverage are avoided.

Standard Gage Co., Inc., Poughkeepsie, N. Y.

**T-11-57**

USE READER SERVICE CARD ON PAGE 175 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

## Surface Grinders

Line of hydraulic precision surface grinders, the Hydrabrasive Numbers 824, 1218 and 1224 (illustrated), is built to provide 12 in. of grinding clearance to the table under a 12-in. wheel. Optionally, the grinders can be built with 18 in. under a 12 in. wheel, and 24 in. models can be extended to 30 in.

Head, spindle and motor are balanced on an elevating screw and col-

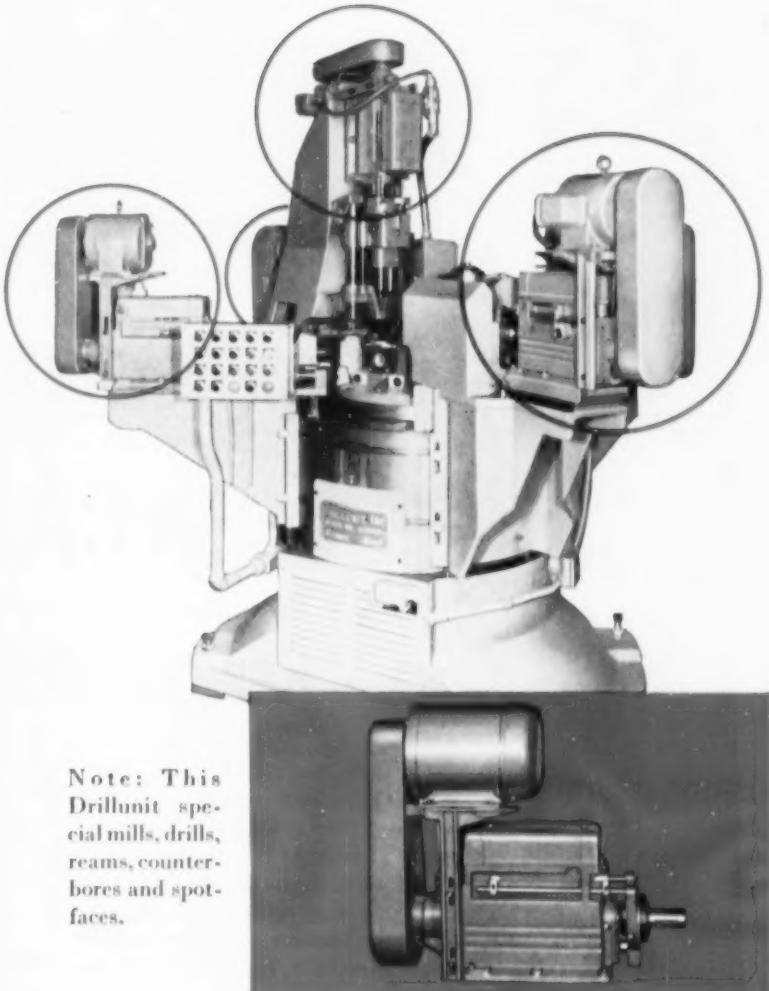


umn ways to facilitate travel up and down the column.

To minimize heat, each of the two hydraulic cylinder rams which actuate the table, is under pressure only half the time. The small, compact hydraulic system is under 200 lb operating pressure. Normal temperature rise in the system is 20 deg. The coolant system is outside the machine.

Controls for the machines are grouped for operator convenience and are mechanically interlocked for safety.

Abrasive Machine Tool Co., Dexter Rd., East Providence, R. I. **T-11-58**



Note: This Drillunit special mills, drills, reams, counterbores and spotfaces.

## NEVER OUTMODED: FOR PEAK PRODUCTION

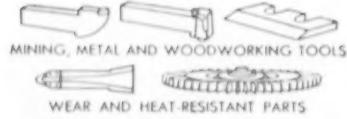
Progress won't obsolete this Drillunit special machine. You'll be able to reconvert and retool at 60% to 80% less cost using the same base, brackets, columns, table and versatile Drillunits outlined in red. Precision-built by Drillunit of Detroit. Write today.

# DRILLUNIT

**DRILLUNIT INC., 3267 WIGHT STREET, DETROIT 7, MICH.**  
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-189



DOUBLE-END TYPE



MINING, METAL AND WOODWORKING TOOLS  
WEAR AND HEAT RESISTANT PARTS

Jobs that "couldn't be done" before...

NOW easily handled with

## The NEW **KENNAMETAL\*** **ENCASED**

### Kendex\* Boring Bars

If you have been having boring-bar troubles, here are some experiences that will interest you:

... At one of the nation's largest steel mills, the shop was unable to complete the contour boring of even a single steel tube, because of extreme chatter of the steel boring bar. A Kennametal encased Kenedex boring bar was substituted . . . and the chatter was completely eliminated.

... At another plant, holes were being bored with a steel boring bar equipped with pilot. The holes were roughed at 950 RPM with a 1-inch per minute feed, and finished at 2-inches feed. Tool life averaged ten holes per grind. The tool cost per piece averaged \$0.49 each for more than 4400 pieces over an 18-month period. Furthermore, at least 50% of the holes had to be reamed either to correct size or taper.

When a Kennametal encased Kenedex boring bar was substituted, feeds

\*Trademark

were almost doubled—to 2 inches per minute roughing and 3½ inches per minute finishing. Tool life has been increased to 70 holes per cutting edge on roughing, and 80 holes per edge on finishing, with a tool cost per piece of \$0.08. Holes are absolutely true to size and taper—the first time the shop had ever been able to hold dimensions with such consistency. It is anticipated that speeds and feeds can be substantially increased, which will effect further savings.

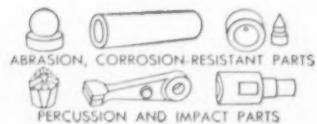
... A well-known equipment manufacturer is using a 1½-inch Kennametal encased bar to bore cast steel at 350 feet per minute, .020-inch feed and approximately ½-inch depth of cut. The bar is used at full overhang—about 12 inches—and no chatter or bar deflection is experienced.

Kennametal Encased Kenedex Boring Bars are available in a range of sizes. For information, write: KENNAMETAL INC., Latrobe, Pa.

C-5093



INDUSTRY AND  
**KENNAMETAL**  
...Partners in Progress



# FIELD notes

A series of one-day seminars has been set up for November and December dates by the Industrial Education Institute for technical and management men interested in learning about and evaluating cost reducing and performance improving industrial techniques. Details are available from the Institute, 25 Huntington Ave., Boston 16.

✓ ✓ ✓

**Transition** from a government-owned atomic energy research facility to complete private ownership and operation has been accomplished by Nuclear Metals, Inc. As a consequence, personnel and facilities of the laboratory are available to industry on a consulting basis. The equipment will be moved from its present location in Cambridge, Mass., to new laboratory buildings now under construction in Concord. The facilities are expected to be completed in late 1958.

✓ ✓ ✓

**Miniature Precision** Bearings, Inc. has announced plans to establish an annual Miniaturization award which will honor the individual or firm who has made the greatest design or manufacturing contribution toward miniaturization and also will stimulate further activity within industry toward advancement of the concept of miniaturization.

## corporate additions

**A wholly-owned subsidiary**, Leeds & Northrup, Canada, Ltd., has been formed by Leeds & Northrup Co. at 61 Industry St., Toronto. The new firm will manufacture and distribute electronic controls and measuring instruments formerly supplied from the United States. J. William Robinson, formerly coordinator of western operations for the parent organization, has been named president of the subsidiary.

✓ ✓ ✓

**A Canadian subsidiary**, The Newall Machine Tool Corp. of Canada Ltd. has been formed by Newall Engineering Co., Ltd., of Peterborough, England. The new firm is empowered to distribute and manufacture products of the parent organization in North America.

**A fundamental** research facility to serve the foil and packaging industries has been established by Aluminum Co. of America. The move represents a consolidation and major expansion of research operations in these fields. It will be located at New Kensington, Pa., and known as the Foil and Packaging Div. of Alcoa Research Laboratories.

✓ ✓ ✓

**A new division** devoted to selling its adhesives and sealants has been formed by Furane Plastics.

✓ ✓ ✓

**A wholly owned** subsidiary has been formed in Canada by Pennsalt Chemicals Corp. The new component, known as Pennsalt Chemicals of Canada, Ltd., will be able to provide improved customer service in that area. William B. Billingsley, who has directed the company's specialty sales in Canada since 1954, has been named vice-president of the subsidiary and resident manager of its operations.

✓ ✓ ✓

**Formation** of Allis-Chalmers International as a major operating division of Allis-Chalmers Mfg. Co. has been announced. The new division will be responsible for all manufacturing, engineering and sales operations and activities outside of the United States and Canada. P. F. Bauer, formerly general manager of the Industrial Equipment Div., is managing director of the new organization.

✓ ✓ ✓

**A manufacturing** division to be known as Boice Threads, Inc. has been added to the facilities of Boice Gages, Inc. The new division, located at 2302 E. 96th St., Los Angeles, Calif., will manufacture thread plug and thread ring gages.

## new facilities

**Ampco Metal**, Inc. is building a \$200,000 branch foundry at Garland, Tex. The 15,000-sq ft plant, expected to be in operation by March, 1958, will include sand and centrifugal foundries,

heat treating facilities and some machining operations. It also will serve as Ampco's principal sales and service offices in the Southwest.

✓ ✓ ✓

**An aluminum** reduction plant of Harvey Aluminum now under construction at The Dalles, Oregon, is scheduled to be in partial operation early in 1958. It will have a planned capacity rate of 108 million pounds annually.

✓ ✓ ✓

**Bay State** Abrasive Products Co. has purchased 15 acres of land in Santa Cruz County, Calif. in preparation for building a manufacturing plant and warehousing facilities. This is the latest step in the company's \$2-million expansion program announced a year ago.

✓ ✓ ✓

**Firth Sterling** Inc. is completing construction of its fourth tungsten carbide sintering facility. The new Los Angeles plant, scheduled to be in production by December 1, will manufacture carbide cutting tool tips and blanks as well as carbide wear parts.

✓ ✓ ✓

**Establishment** of the first of three major regional lift truck replacement parts depots for The Yale & Towne Mfg. Co. has been in San Leandro, Calif. The depots are being set up to provide convenient sources of supply for Yale representatives and branches. Sites for the second and third depots are to be announced later this year.

✓ ✓ ✓

**A new short run** stamping plant has been opened by Federal Tool and Mfg. Co. in North Hollywood, Calif. to provide faster service for West Coast industries. The new division operates under the name of Federal Stamping Co.

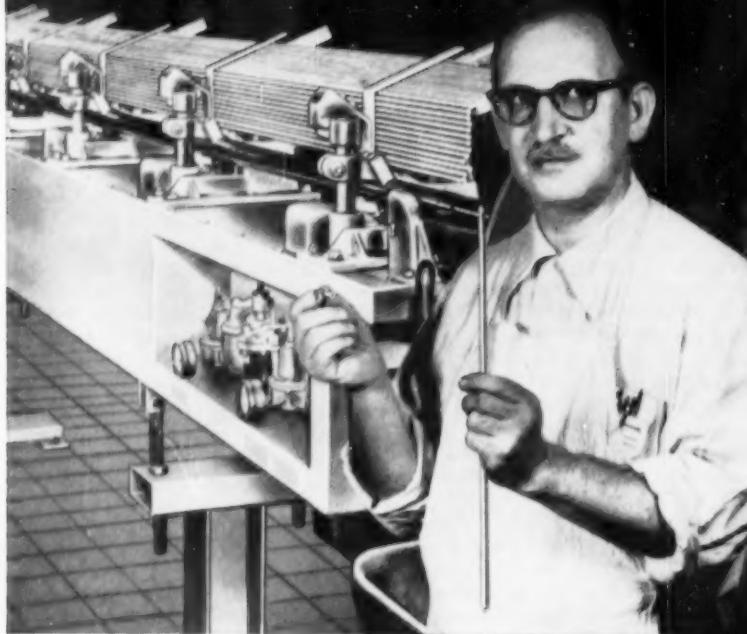
## new companies

**Daystrom, Inc.** has formed a new Controlronics Group designed to provide a single source for complete electronics systems for industrial instrumentation and process control. The group includes Weston Instrument Co., Daystrom Systems Div., and Daystrom Electric. Thomas Allinson, vice-president of marketing of Daystrom, Inc. now also heads the company's newly formed organization.

✓ ✓ ✓

**A group** of scientists and engineers, responsible for many electronic computer developments in industry and defense, have joined to form the Auerbach Electronics Corp. with headquarters in Narbeth, Pa., near Philadelphia. The

**"Stop Cutting Air and you Start  
Cutting COSTS..."**



**Just equip with**

## **LIPE Automatic MAGAZINE LOADING BAR FEED"**

Says Foreman Billy Smathers\*

"We put in two Lipe AML Bar Feeds as a test," explains Foreman Smathers. "At the same cutting speeds as our other screw machines, the AML-fed machines turned out the two pieces I hold in my hands, 78% faster for the small  $\frac{7}{8}$ " piece, and 108% faster for the 16" piece. That opened our eyes . . . but quick! Yet the reasons were perfectly obvious. The Lipe AML's fed stock without pausing. No cutting air. No repeat motion for feed-outs. No down-time for changing feed fingers, or for remnant disposal. The AML's geared our production to the steady pace of the clock . . . so many units of output per so many units of time. Overall, the gain was astonishing!"

**WRITE OR WIRE** for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe AML Bar Feeds in your production layout.

\* photographer's models and pseudonyms used to protect company identity and confidential information.



**Machine Tools • Heavy-Duty Automotive Clutches • Portable Power Hack Saws**

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company, headed by Isaac L. Auerbach, will specialize in application of data processing techniques in the fields of automation, industrial process control, telemetering, automatic test equipment, digital communications, and numerical machine tool control. Until recently, Mr. Auerbach was director of the Special Products Div. of Burroughs Corp.

✓ ✓ ✓

**Zahorski Engineering, Inc.**, with offices in Santa Barbara, Calif., was recently organized to perform research and development in the fields of structures, electronics and mechanics.

✓ ✓ ✓

**A major company** in the ultrasonics industry has been organized by Paul Martin Platzman, New York industrialist and a specialist in ultrasonics. The company, with headquarters in Mineola, L. I., will be concerned with providing ultrasonic cleaning machines and metalworking equipment.

✓ ✓ ✓

**A company** named Air Products (Great Britain) Ltd. has been organized by Air Products, Inc. of Allentown, Pa., and the Butterley Co. of London, England. The organization will be an overseas counterpart of Air Products, primarily involved in design, manufacture, installation and operation of oxygen plants and other low temperature equipment. It is located in Acrefair, North Wales.

### **name changes**

**Name of** Continental Tool Service, Inc. has been changed to Continental Technical Service, Inc. to provide a more descriptive identification in line with diversified technical activities.

✓ ✓ ✓

**The Ohio Piston Co.** has changed its name to Ohio Piston & Machining Co. as part of its diversification program. According to company president K. McKinley Smith, the name change also will make better known the fact that the company is equipped to machine parts other than pistons.

### **acquisitions**

**Detroit Bevel Gear Co.**, subsidiary of Gear Grinding Machine Co., has been sold to Napco Industries. The acquired firm, now a division of Napco, will continue supplying gears to industrial customers and to another subsidiary, Republic Gear Co.

✓ ✓ ✓

**All stock** of Hannfin Corp. is being purchased by The Parker Appliance Co. for approximately \$71.2-million. New

firm name is Parker-Hannifin. According to S. B. Taylor, president of Parker, the two companies make complementary products in the field of fluid power and the combined Parker-Hannifin line will provide a broad range of products which should lead to further expansion of business. No changes are expected in Hannifin personnel, methods of operation or distribution.

✓ ✓ ✓

**The Bellows Co.** and its affiliated companies and divisions have been purchased by the International Basic Economy Corp., an international finance and development firm. According to announcement of the transaction, no change in management is contemplated. Bellows will operate as a division of IBEC.

✓ ✓ ✓

**Assets of Pippin Construction Equipment, Inc.** have been purchased by Cone Automatic Machine Co., Inc. M. J. Pippin, president of the absorbed firm, has been appointed general manager of the new Conomatic-Pippin Div.

✓ ✓ ✓

**A major interest in M.P.J. Gauge & Tool Co., Ltd.** of Birmingham, England, has been acquired by The Sheffield Corp., which plans an immediate expansion of M.P.J. facilities which will enable it to manufacture and sell all Sheffield products in the English market. Initially, production will include products of Sheffield's standard production instruments division.

#### moves

**All office, engineering and production employees and all equipment of Wilco Machine Tool Co., Inc.** have been moved from Manchester, Conn., into the company's new plant on Route 6 in Bolton, Conn.

✓ ✓ ✓

**The Somma Tool Co., Inc.** has moved to its new, specially designed plant on Scott Rd. in Waterbury, Conn.

✓ ✓ ✓

**New York sales office and warehouse of A. Milne & Co., Inc.** has been moved to new, expanded facilities at 636 N. Michigan Ave. in Kenilworth, N. J.

#### expansions

**A \$20-million program for improvements to primary mill facilities at Crucible Steel Co. of America's Midland Works** has been approved by the company's board of directors. It will involve purchase and installation of an

electrically driven blooming and slabbing mill, modifications to the hot strip mill, and additions and improvements in slab heating and other auxiliary equipment.

✓ ✓ ✓

**Link-Belt Co.** has settled into its new plant at 1200 Sycamore St. in Montebello near Los Angeles, Calif., and expects to complete the move of its production facilities during November. The plant more than doubles Link-Belt's facilities in the Los Angeles area, providing approximately 90,000 ft of floor space.

✓ ✓ ✓

**A \$2-million expansion and modernization program is underway at the**

Garden City plant of Arma Div. of American Bosch Arma Corp. The program, which is calculated to result in greater production at much lower costs, is expected to be completed in less than a year.

✓ ✓ ✓

**Columbia Steel Equipment Co., Inc.** recently acquired as a wholly-owned subsidiary by Standard Pressed Steel Co., has announced plans for a 53,000-sq ft addition to its Fort Washington, Pa. plant. The new wing is scheduled for completion early next year.

✓ ✓ ✓

**Property** on Route 37 near Salem, Ill. has been acquired by Vac-U-Lift Co. for a new factory with four times

## FIRST IN FILTRATION ADVANCEMENT

**Delpark**

*Announces . . .*

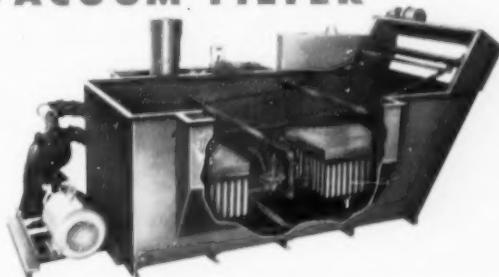
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# Dual Manifold Filter-Matic

## VACUUM FILTER

For Constant, High Efficiency Filtration

• 5 to 1000 G.P.M.  
Flow Capacities • 2  
Different Filter Element Designs • 2  
Forms of Permanent Filtering Media.



Smaller size with greater filtering capacity has been designed into the new Dual Manifold Filter-Matic. Through the Dual Manifold principle, the clean coolant reservoir, no longer a part of the filter, can be varied to meet the specific needs of the system. Constant filtration is achieved by op-

posite cycling of the dual manifolds. When one manifold is filtering the other is backwashing on the cleaning cycle. Absolute filtration is possible through pre-coating.

There's more to tell of the advantages through this newest filtration development for industry.

*Write for more complete information.*

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**INDUSTRIAL FILTRATION COMPANY**

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LEBANON, INDIANA

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## CARBIDE TIPPED

# LAPointe BROACHES

whenever possible!

You can't always use carbide. Your broaching speed may be too slow . . . or your machine may not be sufficiently rigid . . . or perhaps your production requirements are not heavy enough. So we say, "whenever possible."

And when you can, Lapointe inserted-type Carbide Broaches will give you amazing results on long production runs. It is not uncommon for a customer to tell us of getting 100,000 pieces or more between sharpenings!

Proper engineering and careful workmanship make all the difference in the world, in producing broaches with carbide tooth inserts. Here at Lapointe we have valuable experience gained from many years devoted exclusively to the designing and making of broaching equipment. We have had experience in broaching Stellite 31, Stellite 21, titanium, 5616 steel and many others. We suggest that you ask a Lapointe engineer for the latest information on carbide broaches!

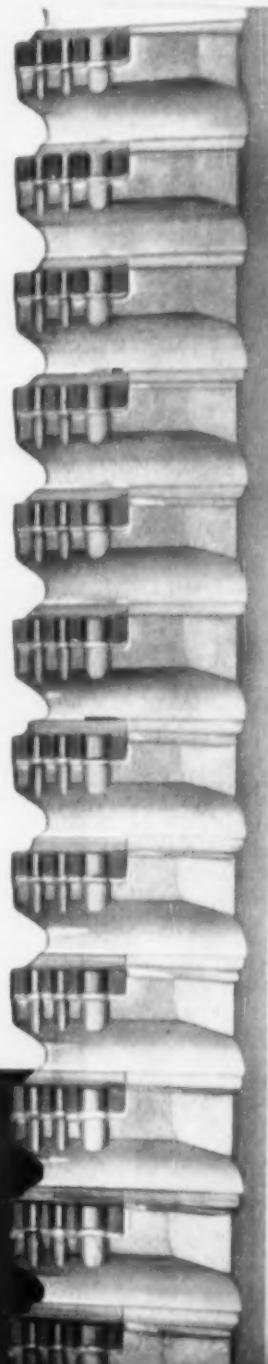
#### THE LAPointe MACHINE TOOL CO.

HUDSON, MASSACHUSETTS — U. S. A.  
In England, Watford, Hertfordshire

THE WORLD'S OLDEST AND LARGEST MANUFACTURERS  
OF BROACHING MACHINES AND BROACHES

# LAPointe

known to be the best in  
**BROACHING**



the company's present manufacturing space. It will have three working bays 40 by 120 ft. and one high bay for fabricating. Another building will house the office and engineering department.

✓ ✓ ✓

An addition of 20,000 sq ft of space is being added to the production area of Container Stapling Corp. with construction of a new factory building scheduled for completion early next year.

#### new association

The Welded Ring Manufacturers' Assn. has been formed with the stated purpose to better fulfill requests of code and specification writing bodies for industry-wide acceptance of new and improved specifications for rings and to assist in formulation of such specifications.

#### anniversary

Tranter Manufacturing, Inc., founded in 1932 as Kold-Hold Mfg. Co., is this year celebrating its 25th anniversary and celebrated the event by meeting its payroll on the founding date with silver dollars.

#### new offices

A Chicago branch office and warehouse has been set up at 2600 S. Throop St. by The Fairbanks Co. to better meet service needs of distributors in the central and plains states. George P. Leckler was appointed manager of the new facility.

✓ ✓ ✓

Sales department of Hughes Aircraft Co.'s semiconductor division has been expanded with the establishment of a field sales engineering office in Palo Alto, Calif. Robert A. Darrow is in charge of the new office.

#### license agreements

Manufacturing rights for the Futurmill structural milling machine have been sold by Futurmill, Inc. to Baldwin-Lima-Hamilton Corp.

✓ ✓ ✓

Exclusive license to handle the Ti-Brite process of removing tough oxide scale from titanium has been granted Delco Chemicals, Inc. by Temco Aircraft Corp. The agreement covers 10 years with a renewal option for six and a half years.

✓ ✓ ✓

Under license from Sir James Farmer Norton & Co., Ltd. of Manchester,

The Tool Engineer

England, Sutton Engineering Co. will manufacture a complete line of Farmer-Norton two-roll bar straightening and polishing machines. The equipment is to be built in all sizes for precision straightening only, or for simultaneous straightening and polishing of metal bars.

#### production notes

**Two new trade names** have been adopted by Firth Sterling Inc. Stercon now identifies consumable electrode vacuum melted alloys, and Stervac designates induction vacuum melted alloys. Both are now available through Firth-Sterling district sales offices.

✓ ✓ ✓

**Availability** of its Hi-Torque bolts in a variety of temperature and corrosion resistant materials in a range of sizes has been announced by Hi-Shear Rivet Tool Co.

✓ ✓ ✓

**Complete line** of radio control equipment for industrial applications are now on the market by C. G. Electronics Corp., wholly-owned subsidiary of Gulton Industries, Inc. Entry into the industrial sales area follows the company's acquisition of complete machine shop facilities in Albuquerque which expanded the printed circuit and electroplating divisions and overall production facilities of the company.

✓ ✓ ✓

**Remco Mfg. Co.** has bought the patent rights and is now manufacturing Rodpak, a metallic, piston or rod type packing.

✓ ✓ ✓

**A range of** larger sizes is being added to its line of electric clutches and brakes by Simplatrol Products Corp. The added range consists of five styles in six sizes from 4 to 12 in. in diameter, with torque outputs from 10 in.-oz to approximately 450 ft-lb.

#### sales

**Electro-Mec** Associates of Ferndale, Mich., has been appointed representative for U. S. Dynamics Corp.

✓ ✓ ✓

**Recent appointment** of Dvorak Machinery Co. of Oak Park, Ill. as distributor in the Chicago area has been announced by The Hamilton Tool Co.

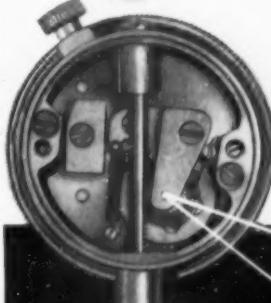
✓ ✓ ✓

**Alloy Precision Castings** Co. has named Tom J. Machia as its sales representative for the state of Texas and Paul Minter and Wayne Simpson for Oklahoma and southern Kansas.

November 1957

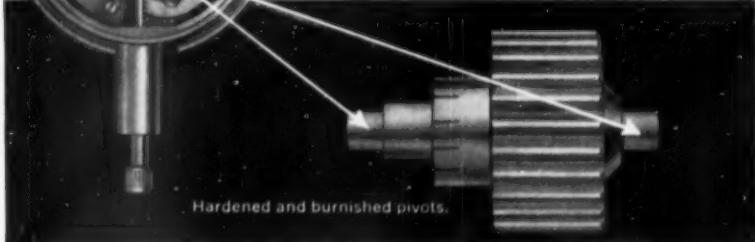
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have hardened and burnished pivots for higher sensitivity — lower friction

Because metal pivots are stronger than jeweled pivots, Ames has developed a method for hardening and burnishing them to match the exceptional smoothness and sensitivity of jeweled types. The result is a dial indicator that is unsurpassed for accuracy — unequalled for strength and durability. And it costs less than jeweled types. This "functional" approach to design and manufacture is just one more reason why the lifetime cost of Ames Dial Indicators is lower, and why so many quality control engineers specify Ames as "preferred". Write today for complete information.



Hardened and burnished pivots.

Representatives in principal cities



**B.C. AMES CO.**

30 Ames Street, Waltham 54, Mass.

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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-195

# technical Shorts

MEASUREMENTS of the temperature of workpiece material is facilitated by a new technique for attaching thermocouples to the workpiece. The method, developed by the Navy, utilizes capacitance welding. Thermocouple wires are welded individually to the workpiece through discharge of a bank

## Welding Method Helps Measure Workpiece Heat

of charged capacitors. A potentiometer controls weld characteristics. The welder is portable and operates from standard power supply.

The capacitance technique overcomes a number of problems encountered in the measurement of workpiece temperatures, such as the errors introduced by inertia of the thermocouple head during rapid heating and cooling. It is said to provide better thermal contact than

mechanical methods. Because of the portability of the welder there is no need for heavy equipment, such as that used in spot welding.

A report of the development, PB 121901 *Attaching Thermocouples by Capacitance Welding*, U. S. Naval Gun Factory, may be purchased from OTS, U. S. Department of Commerce, Washington 25, D. C., for 50 cents.

Using carbon dioxide and a sodium silicate based binder, a new technique has been developed for making semi-precision sand molds for metal castings. The process, announced by National Cylinder Gas Co., combines close-tolerance aspects of shell molding and economic advantages of the carbon dioxide foundry process for conventional sand cores. Most castable metals can be handled. A chemical reaction is produced by the carbon dioxide and the binder which hardens sand molds in from 15 to 30 seconds. Sodium silicate and fine grain sand are mixed and subsequently rammed into a mold pattern. Gassing with  $\text{CO}_2$  forms a silica gel that coats the grains of sand and binds them with a strength that makes molds as thin as one-half inch practical.

All operations in the process are carried out at room temperatures. Consequently it is practical to use aluminum or plastic patterns. In addition, with molds produced in this manner, there is no risk of thermal shock that might result in castings with surface imperfections.

Foundry trials have produced semi-precision molds through this technique to tolerances of  $\pm 0.002$  to 0.004 inch per inch. Under quantity production procedures, NCG officials say that molds can be produced by the  $\text{CO}_2$  method at competitive rates.

DIRECT CONVERSION of chemical energy of gases into electricity has been accomplished at the Research Laboratories of National Carbon Co. with development of a fuel cell capable of

economically producing thousands of watts of power. Hydrogen and oxygen were used as fuel. Hollow, porous carbon electrodes, through which the gases enter the cell and which also conduct the electricity produced by the electrochemical reaction, are chemically treated. The electrochemical reaction of the gases at the

rate Drill Jig Bushings.  Bushings hold dimensional accuracy longer because they're made of chrome bearing steel. **You get them faster, too** . . . "same day" shipment on all cataloged standard sizes. Custom orders receive special custom service. Eight conveniently located warehouses to serve you better. Write today!

## ACCURATE BUSHING COMPANY

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PIERCING PUNCHES

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442 North Avenue,  
Garwood, N. J.

electrodes produces an electric current, with only water as a by-product. Water is disposed of by evaporation, and life of the fuel cell is theoretically unlimited. The cell is designed to work at ambient temperatures and at approximately atmospheric pressure. The cell's normal operating temperature is from 120 to 140F.

According to Dr. Karl Kordes, who has been responsible for the research work, the fuel cells remain essentially unchanged during their operating life and produce electrical energy from chemical fuels supplied as needed. The cell is dead only when the chemicals are used up.

Efficiency of operation of the fuel cell depends on how it is used, says Dr. Kordes, but generally efficiency range is from 65 to 80 percent when operated at normal temperatures and pressures. At lower currents a greater percentage of the chemical energy is converted to electrical energy. Research presently indicates that the optimum fuel cell design will be one which will produce approximately one kilowatt of power from a packaged unit one cubic foot in volume. Voltage across electrodes is approximately one volt—thus it is a matter of connecting a number of cells in a circuit to get any desired voltage.

\*\*\*

WITH COMMERCIAL availability of aluminum powder metallurgy products from Aluminum Co. of America, the uses for aluminum in parts subjected to high temperatures have been considerably broadened. Such products are now being created by subjecting the powder metallurgy

**Aluminum Uses Broadened by Powder Metallurgy**  
metal to heat and pressures and producing them in the form of extruded shapes, forgings, sheet, foil, drawn and extruded tube, impact extrusions, fasteners and wires. Some of the products can successfully withstand temperatures up to 900 F.

The material from which they are made is a fine, unalloyed aluminum powder with each tiny flake being coated with aluminum oxide. When the powder is compacted and worked, the oxide coating strengthens the products and contributes stability at the high temperatures.

At present, three such alloys are available: M257 is made of domestic aluminum powders, produced by Alcoa; M430 and M470 are made of aluminum powders imported from Switzerland. Heat and pressure are used to form the powders into compacts which are later extruded into various shapes for further fabricating.



STYLE AND SIZES FOR ALL MACHINES ON WHICH THREADS ARE CUT

## This die head is unique

### THERE IS NO OTHER LIKE IT

It cuts threads with insert chasers. These are, in reality, small sections of the business end of large and expensive chasers, but with this important difference: *their cost is so low they can be even thrown away when dull.* For example, for less than \$50 you can get a dozen sets of insert chasers, each set ground ready to go. Change now to insert chaser die heads and watch your performance improve. "UNIFIED AND AMERICAN SCREW THREAD DIGEST" sent free on request.

THE EASTERN MACHINE SCREW CORPORATION 27-47 Barclay St., New Haven, Conn.

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# New!

## ALINA SCROLL CHUCK

A truly high precision chuck developed to meet exacting requirements. The method of clamping the largest possible area of the circumference permits minimum use of pressure; fragile work is never deformed or crushed. In order to maintain this advantage chucks over 4" capacity are equipped with eight jaws. Removable jaws are available in a wide variety of styles for internal or external chucking, or they may be had in blank form suitable for your own machining. Simple design permits quick and easy replacement of the shank, and shanks to suit special requirements may be machined at minimum cost in any shop. Six sizes from 2" to 6" to fit all machines. Furnished with or without shanks.



WRITE FOR LITERATURE AND COMPLETE CATALOG

**ALINA CORPORATION**

122 East Second St., Mineola, L.I., N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-11-197-2

# rade literature

for free booklets and catalogs—use convenient request card, page 175

## Marketing, Merchandising

Easy-to-read booklet, "How Abco Sold the Prabble," presents overall concept of marketing, merchandising and advertising, and explains how they are interrelated along with other factors of interest to the small businessman. Howard Weiser Advertising, 16 W. 55th St., New York 19, N. Y. **L-11-1**

## Die Sets

Illustrated 20-page Catalog 70-A, Section 1, on full line of precision and commercial die sets, covers sizes, dimensions, prices and ordering data for both standard two pin series and rear two pin rectangular series. E. W. Bliss Co., Die Supply Div., 1400 Brookpark Rd., Cleveland 9, Ohio. **L-11-2**

## Bending Machines

Extensively illustrated Catalog 356 shows more than 65 different applications in bending tubing, pipe, extrusions and rolled sections; also includes discussion of bending practices and points out special problems in tube bending for the aircraft industry and the machines built especially for that industry; gives complete specifications for all standard models in the line. Pines Engineering Co., 601 Walnut St., Aurora, Ill. **L-11-3**

**ever see a METAL SAW  
that thinks  
for itself?**

**MARVEL**

**POSITIVE FEED**  
**MINIMUM PENETRATION**  
**FRiction FEED**

**MARVEL SAWS'**  
**Automatic "Brain"**  
**Adjusts Blade**  
**Feed Pressure**  
**and Depth on**  
**Every Stroke to**

**GIVE YOU FASTER**  
**CUTTING-OFF**

The exclusive automatic Dual Power Feed built into every MARVEL Series 6 and 9 Hack Saw is the "brain" that adjusts and compensates both pressure and depth of feed correctly in proportion to the number of blade teeth in contact with the work. Once the MARVEL Dual Feed is set, no operator attention is required to insure that the blade is cutting as deeply as possible and practical on every stroke . . . regardless of the changing area of the work being cut. Whether the Saw is being used for continuous automatic cut-off of identical pieces or a single cut, the MARVEL Dual Feed that practically "thinks for itself" guarantees that the work is cut-off in the fewest possible number of strokes.

Heavy duty MARVEL Series 6 and 9 Hack Saws embody every practical design and operating feature to give you speed, accuracy and operating economy you can find in no other metal cutting saws.

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**MARVEL**  
Metal Cutting  
SAWS

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## Electrical Resins

Complete mechanical and electrical details of major Epoxy electrical resins used in industry are explained in new properties chart. Furane Plastics Inc., 4516 Brazil St., Los Angeles 39, Calif. **L-11-4**

## Castings

Mass production techniques and advantages of the Permold process of producing quality engineered castings described in Bulletin GIZ-719; photos illustrate versatility of the process; data concerning physical and other pertinent characteristics also included. General Electric Co., Schenectady 5, N. Y. **L-11-5**

## O-Rings

Eighteen experts have contributed to the contents of 160-page "Parker O-ring Handbook 5700" covering the subject of design and application of synthetic rubber o-ring seals; nine separate sections treat specific phases of the subject; illustrations, tables, charts and other data included. Rubber Products Div., Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio. **L-11-6**

## Titanium Carbide Alloys

Heat resistant titanium carbide alloys and their applications in metal working industries discussed in illustrated Bulletin B-444 on Kentanium; physical properties of 13 different compositions and corrosion resistance are tabulated and charted to show effects of temperature and time of exposure; characteristics of Kentanium are described in relation to types of application. Kennametal Inc., Latrobe, Pa. **L-11-7**

### Precision Machining

Well illustrated Catalog VM-57 on portable Versa-Mil precision Machining tool includes specific application photos for milling, boring, shaping, slotting, grinding, drilling and related machining operations; presents information on how to use the basic unit and seven attachments. The Dumore Co., 1300 Seventeenth St., Racine, Wis. **L-11-8**

### Threading Heads

Bulletin F-90-3 on heat treated threading heads presents information on their construction, design features and advantages; includes dimension and specification tables for both standard and special types; extensively illustrated. Landis Machine Co., Waynesboro, Pa. **L-11-9**

### Magnesium-Thorium Alloys

Photos and charts illustrate 12-page report on "Magnesium-Thorium Alloys: An evaluation of their properties and characteristics"; originally presented as a paper by Donald Mathews, of Hughes Aircraft Co. Brooks & Perkins, Inc., 1950 W. Fort St., Detroit 16, Mich. **L-11-10**

### Grinding Wheel Speed

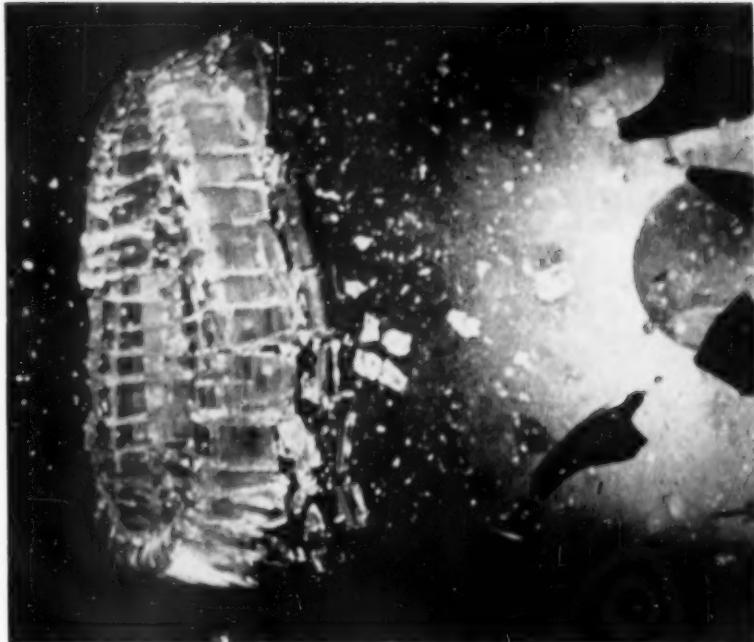
Pocket size selector provides means of choosing correct grinding wheel speed in a given instance; the finger tip slide chart also will determine correct wheel diameter in inches or surface speed in fpm; reference table on back shows recommended speed for each of the standard types and shapes of grinding wheels. Sales Promotion Dept., Simonds Worden White Co., 1101 Negley Place, Dayton 7, Ohio. **L-11-11**

### Drive Selector

Slide rule type plastic device, GEN-169, is designed to assist in selecting proper motor, control panel and operator's station of a general purpose Thyromotrol adjustable speed drive; covers both fractional and integral drives up to 3 hp. General Electric Co., Schenectady 5, N. Y. **L-11-12**

### Bushings

Technical data on bushings, simplified and organized on folder type brochure so it can be seen at a glance, gives bushing types and sizes, drill sizes with their decimal equivalents, concentricity of bushings and Rockwell hardness. A second catalog page presents drill jig bushings for plastic tooling; covers Serragrip for pressing into soft materials, Deltagrip and Hexagrip for imbedding in castable materials. American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, Calif. **L-11-13**



Single frame from a high speed movie of an imploding television picture tube—a critical instant seen in relation to what preceded and followed during a spread-out fraction of a second.

## Ever see a really high speed movie?

It's something to see—a one-second swipe of a cutting tool spread out to three minutes on the screen! Seeing a cam that is really turning at 500 RPM (and behaving that way) as though it were turning at 3 RPM! Studying the action of explosions, welding bead deposition, forging . . . all slowed as much as 200 times from normal.

We've put together a movie on the Kodak High Speed Camera that will show you what high speed movies can do. It will also give you some ideas on how you might put high speed movies to work solving your own design, production, and performance problems that involve high speed mechanical action or fluid flow. To arrange for a showing to company groups of the 16mm sound movie, "Magnifying Time," write:

**EASTMAN KODAK COMPANY, Rochester 4, N.Y.**



FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-199

# NEWEST CONCEPT IN FORMING



## MACHINE SPECIFICATIONS

#V-187

- Max. diam. wire-inches ..... .187
- Max. length of feed-standard 15"
- Max. length of feed-with change gears ..... 30"
- Max. width ribbon metal ..... 1 1/4"
- Stroke of forming slides ..... 2 1/2"
- HP. required ..... 2
- Machine speed-standard 30-120 RPM
- 4 and 20 ton Press Attachments available.

## ADVANTAGES OF THE NILSON VERTIFORM

1. Greater Tool Accessibility
2. Unobstructed View Of Product Being Formed
3. Forming Slide Units Removable and Interchangeable
4. Less Floor Space Required
5. Operator Safety (Most Moving Parts Enclosed)
6. Automatic Oiling Of Entire Machine

Write To Our New Plant For VERTIFORM CATALOG

THE A. H. NILSON MACHINE CO. Bridgeport Ave., Shelton, Conn.



FOR FURTHER INFORMATION, USE READER SERVICE CARD, INDICATE A-11-200

## Blast Cleaning

Illustrated 11-page reference Bulletin 100C offers information on selection, application and operating techniques for hand operated blast cleaning machines; describes fundamental methods of applying abrasives from hand operated nozzle blast cleaning units as well as applications of both wet and soft abrasives. Pangborn Corp., Hagerstown, Md.

L-11-14

## Rust Remover

Properties and uses of Drycid powdered acid scale and rust remover described in service report; outlines convenience features and other advantages of the powdered acid. Oakite Products, Inc., 158 Rector St., New York 6, N. Y.

L-11-15

## Grinding Wheel Dressing

Progress report on perpetual form control for grinding wheel dressing presented in question and answer discussion; includes examples of narrow dimensional limit groove grinding on an automatic basis. Jones & Lamson Machine Co., Springfield, Vt.

L-11-16

## Angle Shears

Bulletin No. DA-2345 emphasizes special features of company's double angle shears and describes the multiple performance possible with them; points out construction advancements and refinements and gives complete specifications of three models available. Request only directly from Kling Brothers Engineering Works, 1320 N. Kostner Ave., Chicago 51, Ill.

## Magnetic Tapes

Six types of magnetic tapes for instrumentation recording are covered in 8-page illustrated booklet; includes charts listing physical and magnetic properties of each tape and a comparison chart summary of major factors in selecting tape for specific application. Minnesota Mining and Mfg. Co., Dept. A7-306, St. Paul, Minn.

L-11-17

## Die Sets and Bolster Plates

Illustrated 16-page Catalog 70-A, Section 2, describes special die sets and bolster plates; gives ordering data, dimensional charts, and data on JIC pressroom standards for bolster plates. E. W. Bliss Co., Cleveland, Ohio.

L-11-18

## Cutters

Descriptive folder presents details on high-speed steel Rick cutters designed with split construction to provide double the number of cutting points. Pittsburgh Stencil & Tool Co., Pittsburgh 12, Pa.

L-11-19

## Cutting Tools

Well illustrated by photos, drawings and charts, 32-page data book, "Practical Cutting Tool Research," by Warner & Swasey engineers and research men, covers application of modern tool materials to production metal turning; presents data from practical point of view rather than strictly theoretical approach; includes time saving tips for increasing production and cutting machining costs. Also gives information on ceramics. Request only directly from The Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

## Profiling Slide Chart

Quick, accurate means for determining the right machining operation that will get a desired microinch finish is provided by this Profilometer slide chart; gives typical applications and tolerances as well as outlining operating instructions. Request only on your company letterhead direct from Micrometrical Mfg. Co., 345 S. Main St., Ann Arbor, Mich.

## Numerical Control

Well illustrated by photos and drawings, 12 page brochure presents information on P&W numerical control equipment for translating blueprint data through various steps and finally into machine positioning. Pratt & Whitney Co., Inc., Charter Oak Blvd., West Hartford 1, Conn.

L-11-20

## Electric Brakes

Thirty-six-page technical report WEB 6293 on electric brake designed for fail-safe applications includes photos, drawings, diagrams as well as explanation of operation, selection factors, torque characteristics and controls. Warner Electric Brake & Clutch Co., Power-Safe Technical Report, Beloit, Wis.

L-11-21

## Tube Working Tools

Catalog 6111 describes and illustrates line of tube working tools for flaring, burnishing, double flaring, cutting, bending and joining copper and JIC steel tubing; includes instructions and specifications for each. The Weatherhead Co., Customer Service Dept., 128 W. Washington Blvd., Fort Wayne, Ind.

L-11-22

## Process Industry Automation

Written in nontechnical language, 16-page illustrated brochure serves to clarify some aspects of automation and indicates some procedures that have been found useful for its development and application with the process industries. Patterson-Emerson-Comstock, Inc., Automation Div., 313 E. Carson St., Pittsburgh 19, Pa.

L-11-23

# MARVEL Synclinal FILTERS

For Efficient Filtration of—  
Hydraulic Oils—  
Fire Resistant Hydraulic Fluids—  
Coolants—Lubricants—  
Water



SUMP TYPE  
(cutaway)

OVER 800  
Original  
Equipment  
Manufacturers  
Install Marvel  
Synclinal Filters  
as Standard  
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Meet  
J.I.C. Standards

PROTECT EQUIPMENT  
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REDUCE MAINTENANCE

Marvel Synclinal Filters installed in the sump or on the line preceding pump offer maximum protection on all hydraulically actuated and other equipment utilizing low pressure circulating oil systems. Maintenance and production costs are reduced because Marvel Synclinal Filters BALANCED design offers greater ACTIVE filtering area with sufficient storage capacity for filtered out damaging particles, thus, longer periods of productive operation are attained at minimum "down time" due to maintenance and repairs.

### PRODUCTION ENGINEERS and MAINTENANCE MEN

whose job it is to keep production machinery operating at peak efficiency and who have recognized the superiority of Marvel Synclinal Filters in the filtration of hydraulic oils, fire resistant hydraulic fluids, coolants, lubricants, etc. are specifying Marvel Synclinal Filters on all new equipment and standardizing with Marvel Synclinal Filters on all machines within their plants. Another outstanding reason for their preference is the simple construction of Marvel Synclinal Filters which allows them to be easily disassembled, thoroughly cleaned and reassembled on the spot, by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

### A SIZE FOR EVERY NEED

Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be attained by multiple installation (as described in catalog). Choice of Monel mesh sizes range from coarse 30 to fine 200.

### IMMEDIATE DELIVERY

Catalogs contain complete engineering data and dimensional charts making it easy to order a filter for your specific requirements and get immediate delivery.

### MARVEL ENGINEERING COMPANY

7227 N. Hamlin Ave., Chicago 45, Ill.

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Without obligation, please send me complete data on  
Marvel Synclinal Filters, as indicated:—

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- Catalog #200—For Fire-resistant Hydraulic Fluids (Aqueous Base)
- Catalog #400—For Fire-resistant Hydraulic Fluids (Synthetic)
- Catalog #301—For Water

Name \_\_\_\_\_

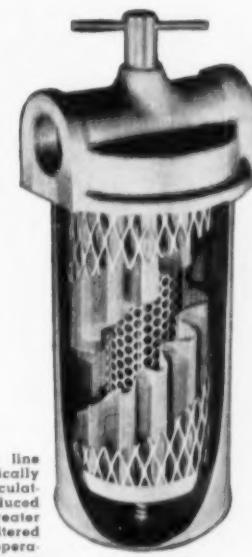
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Catalogs  
containing  
complete data  
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on request



LINE TYPE  
(cutaway)

# 2, 4, 6, 8, or as many as 16 holes

IN A BALER FRAME . . . AT ONCE  
... WITH A SIMPLE  
"HY-POWER" SET-UP



Here's a "Hy-Power" machine that punches as many as 16 holes *at once* in the structural steel sections that make up the sturdy frame of the world-famous New Holland Machine Company hay baler.

This simple, versatile and inexpensive unit—designed by New Holland engineers—makes possible economical, precision, multiple-hole punching of even short runs. Individual cylinders are easily and quickly positioned to meet different job specifications . . . then connected to convenient openings in the pressure and return lines.

The sixteen 5000 p.s.i. "Hy-Power" Cylinders are powered by two exclusive Hannifin "Hy-Power" Hydraulic Pressure Generators . . . compact units including motor, pump, oil reservoir, control valves and high pressure intensifier. This is "Hy-Power" Hydraulics!



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Proved in many fields, "Hy-Power" Hydraulics can provide better, faster production and performance for one-of-a-kind specials like this or for the machines you may build repetitively. Why not investigate this equipment that permits applying forces up to 100 tons . . . in any direction . . . simultaneously? Why not learn all about the nearly 100% salvageability of "Hy-Power" components when set-ups must be changed? A Hannifin representative will explain how you can utilize "Hy-Power" for punching, riveting, staking, bending or crimping operations. Hannifin Corporation, 519 S. Wolf Road, Des Plaines, Illinois.

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Air and Hydraulic Cylinders • Hydraulic Presses • Pneumatic Presses • "Hy-Power" Hydraulics • Air Control Valves



**Paul W. Leming** was elected executive vice-president of Van Norman Machine Co., division of Van Norman Industries, Inc. Mr. Leming, who has a background of more than 25 years in machinery design and production, has been works manager of King Machine Tool and Elmer Engineering Divs. of American Steel Foundries.

**Dwight A. Bessmer** has been elected executive vice-president of The Timken Roller Bearing Co. Mr. Bessmer, who has been associated with the company since 1933, has been a vice-president for the past four years.

**Russell Bellinger**, formerly group leader in the tool and gage design department of Allison Div. of General Motors Corp., has joined the design engineering staff of the Air Gage Div. of Dearborn Gage Co. and will be responsible for design of the company's air gaging products.

New officers elected with President Perkins to serve D. A. Stuart Oil Co., Ltd., at the recent board meeting included **John D. Bryce**, who was named executive vice-president, and **James P. Tomlinson** and **Fred J. Schmitt** who were made vice-presidents of the company. Mr. Schmitt, who belongs to the Chicago chapter of ASTE, is a past chairman and past national director of the society.

**Lester B. Perkins**, formerly executive vice-president of D. A. Stuart Oil Co., Ltd., is new president of the company, succeeding Robert A. Bryce who became chairman of the board.



Election of **Dale V. Cropsey** as vice-president in charge of industrial divisions for Elgin National Watch Co. was recently announced. He joined the firm last July as assistant to the president in charge of developing these divisions.

Election of **I. W. Wilson** as chairman of the board and of **Frank L. Magee** as president has been revealed by Aluminum Co. of America. Mr. Wilson, an Alcoa director for 18 years and company president since 1951, succeeds Arthur Vining Davis who retired. Mr. Magee has been executive vice-president of Alcoa since April, 1955, and a company director since 1952.

**R. E. Esch**, general manager of the International Div. of Vickers, Inc. since its formation early this year, has been elected a vice-president of the company.

Universal-Cyclops Steel Corp. has named **Richmond P. Hobson** works manager of the new stainless steel plant to be built at Coshocton, Ohio.

**Albert H. Clarke** and **Russell P. Northup** have been promoted by Crouse-Hinds Co. Mr. Clarke, former vice-president for engineering, was named vice-president for manufacturing. Mr. Northup, who was commercial vice-president for Condulet sales, now fills Mr. Clarke's former post and will supervise the company's product research and development programs.

**Robert R. Rhodehamel**, general sales manager of National Acme Co., now also is a vice-president of the company. An authority on machine tools, he belongs to ASTE's Cleveland chapter.



**Wilbur L. Kennicott** was recently elected a vice-president of Kennametal Inc., where he has been head of engineering activities. He also is a member of ASTE's Pittsburgh chapter.



**Edward P. Gillane**, who is president of Pratt & Whitney Co. and chairman of the board of Potter & Johnson Co., now is also executive vice-president in charge of industrial operations for Penn-Texas Corp. He continues as chief executive officer of P&W, a Penn-Texas subsidiary. Mr. Gillane is a member of ASTE's Hartford chapter.

Advancement of **Milton J. Steffes** from vice-president of sales and engineering to vice president and works manager has been made public by Super Tool Div. of Van Norman Industries.

**Roy Norton** was named director of engineering for Long Mfg. Div., Borg-Warner Corp. He previously served as assistant director of engineering and as transmission engineer.

Officers elected at the annual meeting of AMTDA to serve with new President Habicht include **J. O. Ellison**, who became first vice-president, **J. Russell Clarke**, now second vice-president, and **George E. Merryweather**, who was named secretary-treasurer. Mr. Ellison, a member of ASTE's Golden Gate chapter, is president of Harron, Rickard & McCone Co. Mr. Clark is president of White Star Machinery & Supply Co., Inc. Mr. Merryweather is vice-president and secretary of The Motch & Merryweather Machinery Co.

**Frank H. Habicht** was elected to serve as president of the American Machine Tool Distributors Assn. He is president and general manager of Marshall & Huschart Machinery Co.



Standard Pressed Steel Co. has made **John J. Wiest** technical director of the locknut department, a newly created position. Formerly manager of sales of the company's Flexloc locknut products, he now heads a new program for preparation of technical data on SPS nut products and their applications.

At their recent annual meeting, conference and exhibit, members of the Instrument Society of America elected **Robert J. Jeffries** as president for 1957-58. Mr. Jeffries is assistant to the president of Daystrom, Inc. **Henry C. Frost**, assistant chief engineer of Corn Products Refining Co., was elected ISA's new president-elect-secretary and is slated for presidency of the society in 1958-59.

Changes in executive assignments at E. W. Bliss Co. involved **John Lindberg**, who became manager of the Canton Div., **Richard Y. Moss**, now manager of special products sales, and **Charles E. Peterson**, who was made manager of manufacturing operations for Mackintosh-Hempill Div. in the post formerly held by Mr. Lindberg. Mr. Moss previously was Canton Div. manager, while Mr. Peterson was formerly chief metallurgist of Mackintosh-Hempill Div.

**Paul V. Malloy** was named vice-president-operations of Kemet Co., Div. of Union Carbide Corp. Associated with Union Carbide since 1915, he has been the company's chief engineer until this appointment.

Appointment of **James R. Davidson** to the post of vice-president and general sales manager has been announced by Capac Industries, Inc. Prior to this appointment, he was executive secretary of the Society of Plastics Engineers, Inc.

Sundstrand Machine Tool Co. has announced appointment of **Allen E. Hermanson** as manager of the machine tool divisions in Belvidere and Rockford, Ill. He has been assistant manager of the divisions.

Appointment of **Stanley L. Albright** to the recently created position of manager of product planning has been announced by Hunter Spring Co. At the same time, it was revealed that **James E. Hunt** had been named product planning engineer. Mr. Albright has been assistant to the plant manager, while Mr. Hunt was formerly manufacturing engineer.

Crucible Steel Co. of America has named **J. D. Dickerson** to fill the newly created post of manager-steel production. He has been staff assistant to the vice-president-operations.

**George W. Hoffmeister** has been named general superintendent of Minneapolis-Honeywell Regulator Co.'s new plant at Fall River, Mass. Previously he was superintendent of assembly operations at the company's Brown Instruments Div.

Lindberg Engineering Co. has named **K. A. Lang** as general manager of its manufacturing plant in Downey, Calif. He also will be responsible for sales activities of the company and of Lindberg Industrial Corp. in Downey, San Francisco, Seattle and Denver.

Several promotions have been made public by Northwestern Tool & Engineering Co. **George R. Lewis** was made plant superintendent; **Wilfred Quinter** became production foreman, and James Wallace is now inspection and quality control supervisor.

Announcement of the appointment of **Kenneth H. Meyer** to the post of director of engineering has been made by C. B. Hunt & Son, Inc. Mr. Meyer joined the company in 1954 as assistant chief engineer.

Surface Combustion Corp. announced election of C. Cone, chief engineer of the Industrial Divs., and **J. I. Trimble**, chief engineer of the Janitrol Divs., to vice-presidencies of the corporation. The company also has revealed appointment of **W. H. Dailey, Jr.** as sales manager of the new Pelletizing Div. He has been chief engineer of the Steel Mill Div., a post now filled by **R. C. McCarthy**, former assistant chief engineer of the division.

**You eliminate  
60% WASTE  
WITH  
PROVEN METCUT  
TWO-PIECE CORE  
DRILLS**

Quick-Change Replaceable Tips  
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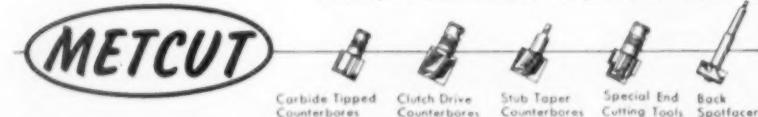
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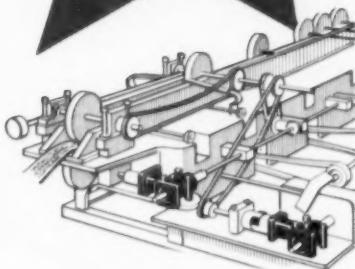
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November 1957



**CLOSED CIRCUIT TV SYSTEM PLANNING**  
—by Morris A. Mayers and Rodney D. Chipp. Published by John F. Rider Publisher, Inc., 116 W. 14th St., New York II, N. Y. Price \$10. 262 pages.

This book provides the information needed to decide intelligently where and how a particular organization can best use closed circuit television. It discusses in detail the concept of such systems, their utility and functioning. This is neither an engineering nor a technician's text; it is a book especially written to give management the facts.

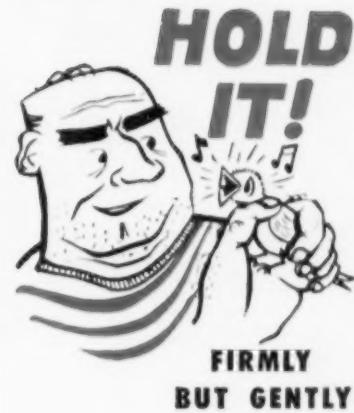
The book is divided into three parts: Part I, Application of Closed Circuit Television; Part II, How Closed Circuit Television Works; and Part III, Equipment. At the end of each part is a bibliography. Also included is a three-section appendix: (1) Closed Circuit Producers, Syndicators and Service Organizations; (2) Manufacturers of Closed Circuit TV Equipment; (3) Cost Data.

Through detailed descriptions and photographs, the many advantages of industrial television can be seen. These actual instances are not only interesting reading, but illuminating and thought-provoking discussions which may lead the reader to adaptations suitable to his own purposes.

**MATERIALS HANDBOOK—8TH EDITION**  
By George S. Brady. Published by McGraw-Hill Book Co., Inc., 33 W. 42nd St., New York 36, N. Y. Price \$11. 1022 pages.

For the purchasing executive or the product engineer who must think in terms of a wide variety of materials, nothing is as practical as a book giving pertinent data on approximately 10,000 materials.

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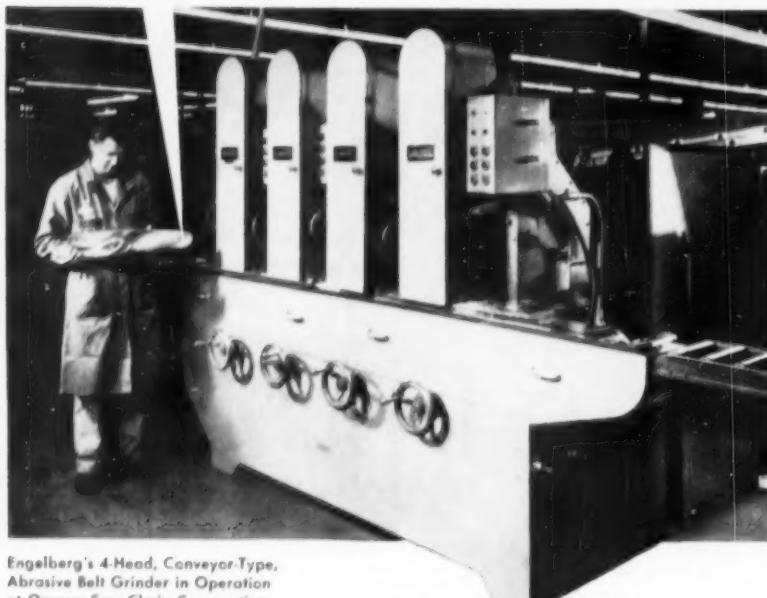
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tutes, adulterants and uses for such. It is not intended to provide an exhaustive treatise on any material.

Now new materials have been added and the old materials have been brought up to date. Also included are patented and trade name materials to give a more specific understanding of commercial applications. A feature of the book is the economic data in Part II. This section presents basic information on the economic geography of material resources, weights, measurements, physical comparisons on the various materials, enabling the engineer not only to see the administrative "how" of using materials but also to understand the "why" in fundamental terms.

**A BIBLIOGRAPHY OF FLUID POWER**—*Prepared by the National Fluid Power Association, 1618 Orring on Ave., Evanston, Illinois. Price \$2. 186 pages.*

Although this bibliography is not comprehensive, it does represent a valuable cross section of the best literature available on fluid power. In general, only books have been included. Although a tremendous amount of information is available in the form of magazines and journal articles, neither time nor space has made possible their inclusion.

The material within this bibliography is broken down into three major divisions: hydraulics, pneumatics and fluid power (which embraces both pneumatics and hydraulics). These major divisions are further subdivided into the categories: general, basic theory, data and tables and applications.

A code system simplifies the process of finding information on a desired subject. Also an alphabetical subject index follows the bibliography while an alphabetical author-title index follows the subject index.

In all, the bibliography serves as much needed reference that will find increasing use with tool engineers.

**RADIUS TURNING ON A MILLING MACHINE**—*By R. A. Jones, Senior member Los Alamos chapter. Published by The A. B. Hirschfeld Press, Speer Blvd., Denver, Colorado. Price \$2. 80 pages.*

This "how-to-do-it book" was written because of the ever increasing demand by industry for machine shop and engineering personnel to understand how a precision radius is generated on a milling machine.

Divided into four basic sections, the book discusses equipment needed, procedure required, reference tables and shop safety practices. A step-by-step ap-

proach has been used and it is written in terms easily understood by engineers and laymen alike. However, the processes explained and illustrated have been proven for precision requirements.

Throughout the book, pages have been left blank for the convenience of the user who wishes to make additional notes or sketches during the course of his work. The home workshop hobbyist, machinist and engineer will find the book interesting and will prepare him for radius turning when the situation arises.

**MECHANICAL VIBRATIONS**—By *Bernard Morrill*. Published by *The Roland Press Co.*, 15 E. 26th St., New York 10, N. Y. Price \$6.50. 262 pages.

This book is designed for the first course in fundamental theory of mechanical vibrations. Its purpose is to enable the advanced undergraduate or graduate student to master the mathematical techniques which will equip him to utilize to the utmost the more advanced literature in the subject.

Assuming an adequate background in integral calculus, the book introduces the student to the solution of a second order linear differential equation at an early point. After demonstrating the use of this mathematical tool, the book then introduces partial derivatives sufficiently so that the Lagrange equations can be developed. The solution of partial differential equations by the separation of variables method is then presented. This extends the area of solution of problems in the field of mechanical vibrations to vibrations in a continuous medium. The last chapter, entitled "Miscellaneous Topics," introduces the electrical analogy, the mobility method and an elementary discussion of the analogue computer.

**WORK SAMPLING**—by *Ralph M. Barnes*. Published by *John Wiley & Sons, Inc.*, 440 Fourth Ave., New York 16, N. Y. Price \$7.95. 296 pages.

Random sampling for measuring activities and delays of men and machines has been used in industry for over 25 years, but work sampling for establishing time standards is a more recent development.

This book provides a reference and guide to work sampling studies. The fundamentals are explained clearly and specific directions are offered to show how to apply this measurement technique in an office or factory.

Case histories illustrate the applications in actual situations.

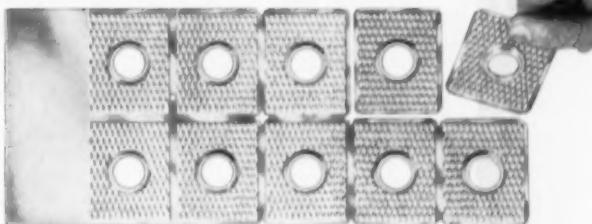
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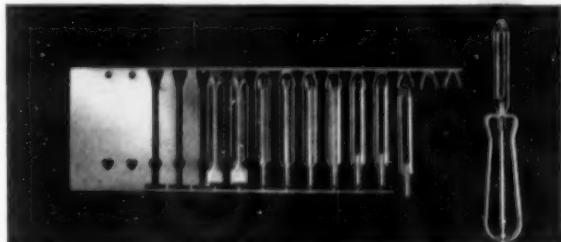
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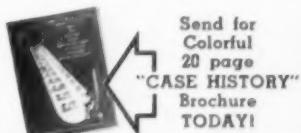
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# who's meeting and where

**Nov. 2-8.** AMERICAN SOCIETY FOR METALS. National Metal Exposition and Congress and annual meeting, International Amphitheatre and Palmer House, Chicago, Ill. Second World Metallurgical Congress also will be held in conjunction with this meeting. Society office, 7301 Euclid Ave., Cleveland 3, Ohio, can supply details.

**Nov. 4-6.** AMERICAN INSTITUTE OF

ELECTRICAL ENGINEERS. Machine tool conference, Hotel Schroeder, Milwaukee, Wis. Institute offices, 33 W. 39th St., New York 18, N. Y. can supply more information.

**Nov. 4-6.** SOCIETY OF AUTOMOTIVE ENGINEERS. Diesel engine meeting, Statler Hotel, Cleveland, Ohio. Contact SAE office, 485 Lexington Ave., New York 17, N. Y. for details.

**Nov. 5.** INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC. Sixth IHEA-ASM symposium on modern heat treating equipment, during World Metallurgical Congress, Chicago, Ill. Request details from association headquarters, Associations Bldg., Washington 6, D.C.

**Nov. 6-8.** INDUSTRIAL MANAGEMENT SOCIETY. Time and motion study clinic, Sherman Hotel, Chicago, Ill. More facts may be had from society office, 35 E. Wacker Dr., Chicago 1, Ill.

**Nov. 6-8.** SOCIETY OF AUTOMOTIVE ENGINEERS. Fuels and lubricants meeting, Statler Hotel, Cleveland, Ohio. Send for details to SAE office, 485 Lexington Ave., New York 17, N. Y.

**Nov. 11.** SOCIETY OF PLASTICS ENGINEERS, INC. Regional technical conference on "Plastics for Air-Borne Electronics," Ambassador Hotel, Los Angeles, Calif. For details, write to L. J. Costanza, 8017 Holy Cross Pl., Los Angeles 47, Calif.

**Nov. 11-13.** ELECTRONIC INDUSTRIES ASSOCIATION. Fall meeting, King Edward Hotel, Toronto, Canada. For more information, contact association Engineering Dept., 650 Salmon Tower, 11 W. Forty-Second St., New York 36, N.Y.

**Nov. 11-13.** INSTITUTE OF RADIO ENGINEERS. Instrumentation conference and exhibit, Biltmore Hotel, Atlanta, Ga. Send inquiries to B. J. Dacher, School of Electrical Engineering, Georgia Institute of Technology, Atlanta, Ga.

**Nov. 13-15.** AMERICAN STANDARDS ASSOCIATION. Eighth National conference on standards, St. Francis Hotel, San Francisco, Calif. Request details from association headquarters, 70 E. 45 St., New York 17, N. Y.

**Nov. 18-21.** AIR CONDITIONING & REFRIGERATION INSTITUTE. Tenth exposition, International Amphitheatre, Chicago, Ill. Write for details to Banner & Greif, 369 Lexington Ave., New York 17, N.Y.

**Jan. 6-8.** RELIABILITY AND QUALITY CONTROL, fourth national symposium, Hotel Statler, Washington, D. C. Complete data is available from Richard M. Jacobs, RCA Bldg. 108-2, Moorestown, N.J.

**Jan. 27-30.** PLANT MAINTENANCE & ENGINEERING SHOW AND CONFERENCE. International Amphitheatre, Chicago, Ill. For complete information, contact exposition managers, Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N.Y.

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**Jan. 28-31.** SOCIETY OF PLASTICS ENGINEERS, INC. 14th annual technical meeting, Sheraton-Cadillac Hotel, Detroit, Mich. Details may be obtained from C. H. Whitlock, C. H. Whitlock Associates, 21655 Coolidge Hwy., Oak Park 37, Mich.

**Dec. 1-6.** AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Annual meeting, Statler and Sheraton McAlpine hotels, New York City. For other data contact ASME headquarters, 29 W. 39th St., New York 18, N. Y.

**Dec. 5-7.** NATIONAL ASSOCIATION OF MANUFACTURERS, Congress of American industry, Waldorf-Astoria Hotel, New York City. Complete data may be had from association headquarters, 14 W. 49th St., New York 20, N. Y.

**Dec. 8-11.** EASTERN JOINT COMPUTER CONFERENCE, sponsored by Institute of Radio Engineers, American Institute of Electrical Engineers and Association for Computing Machinery. Details are available from Morton M. Astrahan, IBM Corp., San Jose, Calif.

**Jan. 30-31.** AMERICAN SOCIETY FOR ENGINEERING EDUCATION, relations with industry division, 10th annual College-Industry Conference, University of Michigan, Ann Arbor, Mich. Other information is available from U of M College of Engineering, 255 West Engineering Bldg., Ann Arbor, Mich.

**Feb. 3-4.** INSTRUMENT SOCIETY OF AMERICA. Conference on progress and trends in chemical and petroleum instrumentation, Wilmington, Del. For more data write to H. S. Kindler, director of technical programs, ISA, 313 Sixth Ave., Pittsburgh 22, Pa.

**Feb. 4-6.** THE SOCIETY OF THE PLASTICS INDUSTRY, INC., Reinforced Plastics Div. 13th annual technical and management conference and industry exhibit, Edgewater Beach Hotel, Chicago, Ill. Contact society office, 67 W. 44th St., New York 17, N.Y.

**Feb. 18.** ROCHESTER SOCIETY FOR QUALITY CONTROL. 14th annual quality control clinic, War Memorial, Rochester, N.Y. For details, write to Edward F. Winterkorn, Eastman Kodak Co., Navy Ordnance Div., 50 Main St. West, Rochester 14, N.Y.

**Mar. 17-21.** ENGINEERS JOINT COUNCIL. Nuclear Congress, sponsored by 30 national groups, International Amphitheatre and Palmer House, Chicago, Ill. For information address congress manager, American Institute of Chemical Engineers, 25 W. 45th St., New York, N.Y.

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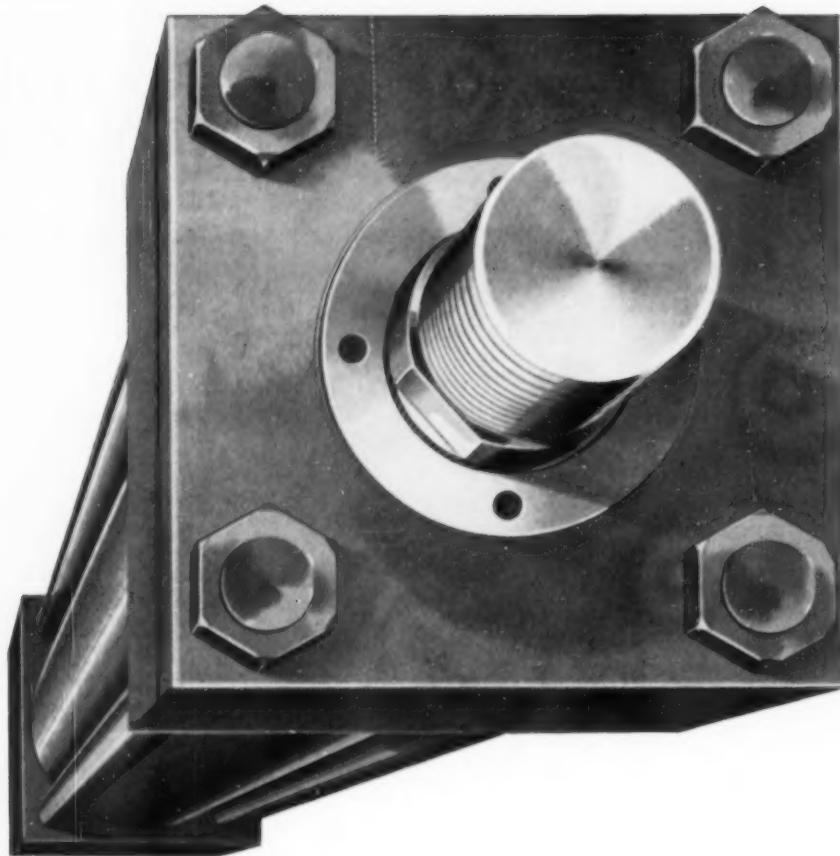
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# a machine tool builder looks at numerical control

## Tech Digests

By Ralph E. Cross

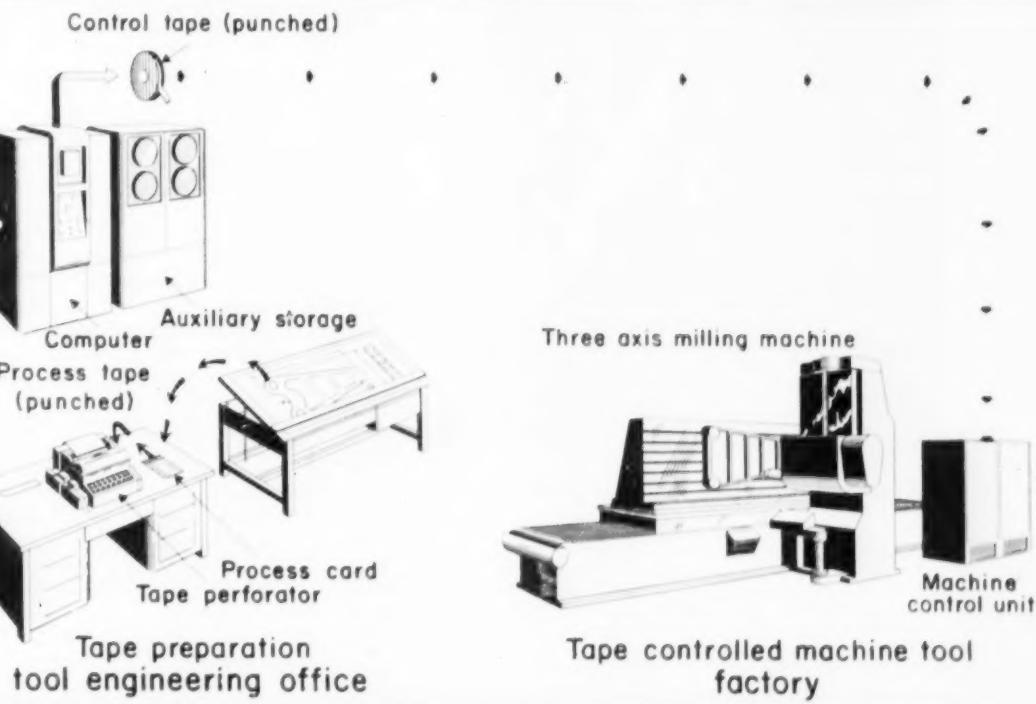
Executive Vice President  
The Cross Company  
Detroit, Mich.

Today, the machine tool industry is stronger, younger minded and better prepared to contribute its share to the growth of America than at any time in its history. There are many technical and economic reasons for this, but I am only going to deal with one of them today, and that is with the new machine technologies developing around numerical control. New concepts of automaticity are in the making, especially for machine tool users who work

in small production quantities. Observers close to the machine tool industry can see significant changes taking place in the design of our basic machine tools right now, and the tempo of change is on the increase. The machine tool industry is not going to revolutionize metalworking overnight, but I think we can safely say that in the next five years new numerically-controlled machine tools will obsolete many of the machines that are now considered to be

profitable investments.

The Air Force has purchased over 100 numerically controlled machines for air frame production. These machines, which are scheduled to go in operation between now and 1959, are accelerating the introduction of other numerically controlled machine tools. They will not necessarily be the machines used by big business for mass production. More than likely they will be the machines used by thousands of small plants



Typical tape-controlled manufacturing system, developed by the Research Laboratories Div., Bendix Aviation Corp. Working from blueprints, cutting speed data and other information, tool engineers record machine instructions on tape. These instructions are transferred to a machine control tape which feeds instructions to the machine.

throughout the country. For example, one of the first, if not the first, semi-automatic jig boring machines with numerical control was delivered to a small shop in Detroit, which employs less than twenty men. I saw this machine in operation and, in my judgment, it will more than pay for itself in the first year.

About two months ago, I made a rough estimate of our ability to apply numerically-controlled machines at The Cross Company, and I came up with the figure between 1 and 2 million dollars worth of machines in the next five years.

Look almost anywhere in the metal-working industry, and you will find a place for numerically-controlled machines. Boiler manufacturers can profitably use numerically-controlled machines for drilling tube sheets. Cam and turbine blade milling machines are ideally suited for numerical control. Gear cases and other components for aircraft, diesel engines, printing presses, road machines and miscellaneous machinery can be milled, drilled and bored

profitably with numerically controlled machine tools.

Thinking of the machine tool industry is pretty well summed up by the following statement by one of its leaders: "Five years from now all industries will be using numerical control to a greater or lesser extent. This extent will depend upon the size and complexity of the product and on the cost of numerical control.

At the top of the list of machines that have the greatest potential for numerical control, I would put milling machines—particularly the larger type such as skin mills and milling machines for various types of contour milling on large and complex shapes. This is because operations on such machines are usually pretty complex, parts are put through in comparatively small quantities, and the cost of the machine itself is large enough so that the extra cost for numerical control can be more easily absorbed.

From that I would go to the other extreme—that is to say, machine tools where the numerical control is used for positioning only. This would include boring mills, jig borers, drill presses and the like. The reason for this thinking is, at least partially, because numerical control for table positioning is

comparatively simple and inexpensive. Also in this field there may, under certain conditions, be an application for numerical control in high production.

The next group would include knee-type milling machines, lathes of various types, and pantograph machines of various descriptions.

I believe, of course, that all machine tools will use numerical control to some extent, but the above types, in my mind, offer the greatest potential."

Rough estimates from authoritative sources show that there are a total of 1,700,000 machine tools in use today, which could be improved by the use of numerical control.

From a talk given before the Technical Symposium on Numerical Control Systems for Machine Tools, National Machine Tool Builders' Association, 2071 East 102nd Street, Cleveland 6, Ohio.



## Molybdenum for Aircraft Applications

By R. T. Begley

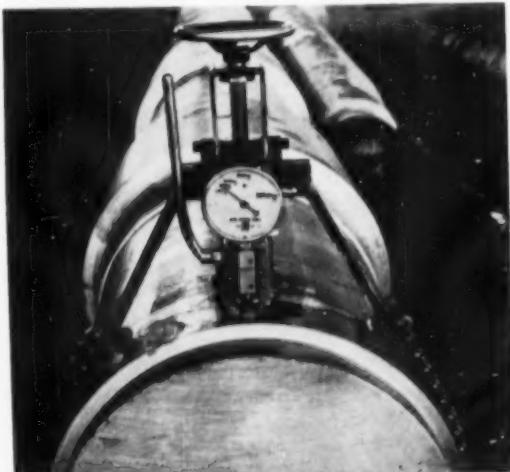
Aviation Gas Turbine Div.  
Westinghouse Electric Corp.

As long as we continue to fly in the earth's atmosphere, we are faced with a heating problem which grows ever more severe as flight speeds increase. One of the most obvious approaches to the problems presented by the thermal barrier is the development and utilization of improved high-temperature materials.

During recent years several molybdenum-base alloys have been developed which exhibit outstanding high-temperature strength. These alloys have a higher useful strength at temperatures over 1600 F than any presently known materials. The elevated temperature ductility of molybdenum and its alloys is more than adequate for virtually any application. Final elongation in stress rupture tests is generally 10 percent or greater and reduction in area is usually over 50 percent.

In addition to its excellent high-temperature strength, molybdenum has a high modulus of elasticity, a desirable property in applications where buckling is a critical factor. Molybdenum's high thermal conductivity is effective in reducing hot spots in components where nonuniform temperature distribution is a problem.

The molybdenum-base alloys now being considered for applications in the jet propulsion field are produced by the arc-cast process. Although alloys with equivalent high-temperature properties have been made by powder metallurgy techniques, the arc-cast material



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is currently preferred because of availability and fabrication characteristics.

Molybdenum's main disadvantages for aircraft applications are its relatively high density, the difficulty of obtaining high-strength joints and its absolute lack of oxidation resistance. Despite the high density of molybdenum, however, the strength-weight ratio of molybdenum-base alloys is still significantly superior to conventional superalloys at temperatures over 1600F.

Molybdenum and its alloys may be fabricated by most conventional techniques and, although the problem of obtaining high-strength joints has not been fully solved, satisfactory welding methods have been developed for a number of applications.

Because of the lack of oxidation resistance of molybdenum and its alloys, some form of protective coating must be applied if molybdenum is to be used in an oxidizing atmosphere at temperatures over 1000 F. The requirements

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for a coating which will successfully protect molybdenum components at elevated temperatures depend, of course, on the temperature range, length of exposure and environmental conditions. For use in gas turbine components such as turbine blades, which operate in the 1800-2100 degree range, coating materials should provide protection for 50 to 100 hours. They must have high impact, shock and corrosion resistance as well. Other required characteristics are ductility, compatibility with base metal, ease of application and ability to withstand normal handling.

A wide variety of coating materials and methods of application have been investigated in recent years. Electro-deposited Cr-Ni coatings, Al-Cr-Ni sprayed metal coatings, claddings of Ni and Ni-Cr alloys, and Ni-Cr-B coatings applied by metal spraying or brazing techniques appear to be the most promising coatings at present. Future improvements in coatings—and in molybdenum alloys themselves—should substantially aid in penetrating the thermal barrier.

From a paper given at the National Aeronautic Meeting, Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, New York.

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## CASE HISTORY #16 MID-WEST HEAVY MACHINERY MANUFACTURER



7/16" & 1/4"  
REAMERS  
Series 1564

OPERATION Reaming 7/16" x 1/2" deep hole  
Reaming 1/4" x 5/8" deep hole  
MATERIAL Cast Stellite, Rockwell C48  
SPEED-FEED 7/16" dia.—350 r.p.m.  
1/4" dia.—900 r.p.m.  
PRODUCTION 100 to 180 holes per tool.  
Carbide Tipped reamer  
produced 10 holes. H.S.S. none.



## CASE HISTORY #25 MAJOR AUTOMOBILE MANUFACTURER



SPECIAL  
END MILL  
3/8" diameter  
Series 1507

OPERATION Milling transmission bodies.  
Plunge 3/4" and slot 7/8"  
MATERIAL Cast Iron  
SPEED-FEED 3840 r.p.m.—.0024 feed per  
revolution  
PRODUCTION 60,000 to 70,000 slots per tool.  
Previously used 1000 H.S.S.  
End Mills per month, now uses  
24 Atrax mills.



## CASE HISTORY #42 MAJOR AIRCRAFT CORPORATION



H-183 and K-183  
BURS

OPERATION Burring  
MATERIAL Kirksite Dies  
SPEED-FEED 15,000 to 20,000 r.p.m.  
PRODUCTION Solid Carbide Burs ran 1200  
hours average before resharpening. Previously, resharpening  
H.S.S. burs cost company  
\$100 a day.



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## Effective Engineering Management

By Tyler E. Williams

Industrial Engineer  
Rock Island Arsenal  
Rock Island, Ill.

Engineering is having an increasingly greater impact on American life. The B-47 bomber, for instance, required

3,464,000 man-hours of engineering efforts as compared to 85,000 hours for the B-17. This trend is continuing and it won't be any easier to hire a good engineer five or ten years hence than it is now. The obvious solution is to make better use of available engineers; in a word, effective engineering management.

A simple definition of effective management is "... a process by which you get where you had planned to be within the time allotted and at the cost predicted." This is far removed from the usual formal definitions, but it does indicate the three essentials of the

management process: a plan, an appropriate organization and controls.

A plan is just exactly that—a statement, formal or informal, of what is to be done. The organization is tailored to suit the need; that is to fit the plan. Controls, too, must be appropriate to the job at hand.

Once a plan has been decided upon, organization charts and position descriptions can be worked out. This done, controls can be established. Generally speaking, any control that is not strictly a cost control can be classified as a management control. A control, being a standard of comparison against which to check results, implies that standards have been set up. Also needed are control points, units of measurement and appraisal of results.

There is no better place to control engineering effort than with the engineer himself. A record of the hours expended on a specific project and percentage of completion of the project is probably the only valid basis for an engineering control system. Attempts at setting sophisticated work measurement standards usually fail because of the nature of engineering work.

Control information, to be worth its salt, must be as current as possible. From the supervisor's point of view, the best possible control block would be day-by-day. Control periods longer than one week are usually ineffective. There should be a minimum time period between data generation and management appraisal so that problems can be corrected while they are still problems and favorable circumstances can be capitalized on while they remain favorable.

The further up the line a report must go to be acted upon, the greater the time lag. Obviously, excessive organizational layers are detrimental to any control plan.

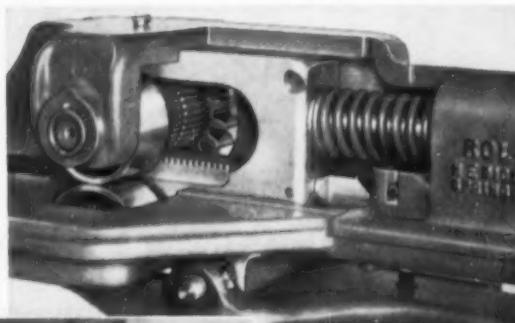
The talented top-notch engineer who makes a good administrator is a rare individual. Nevertheless, many engineers move into administrative jobs because such jobs have higher status than engineering work. Thus the creative engineering talent of the individual is lost to the organization. One solution, adopted by the General Electric Co., is to set up parallel lines of advancement for managers and engineers.

Money alone, of course, is not the only solution. An engineer, like any professional person, asks for and can logically demand professional responsibility in accord with his level. This, in conjunction with a recognition of the contribution that the engineer can make to the organization as an engineer, is the only approach to the final answer.

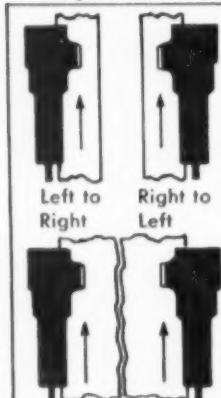
From a paper presented at the Engineering Organization Institute, University of Wisconsin, Madison, Wisconsin.

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## A Psychologist Looks at Supervision

By Dr. James W. Rohrer

Rohrer, Hibler, and Repleglo  
Milwaukee, Wisconsin

When we are dealing with automation, work sampling, scheduling and similar matters, we are dealing with tangible things. They are the kind of problems you can do something about by the application of certain rules, procedures and methods, and you can get some definite measure of how effective they are or are not.

Supervision is another story. We cannot always say that if we supervise by method "A" we will get result "B." In supervision, we're dealing with the human variable: not just one complex human being but many of them. Although one approach will work well with one individual, there is no guarantee that the same approach will work well with the next.

As supervisors, you are concerned with a number of things. You must make certain that schedules are met, that accuracy is maintained, that procedures are followed, and so on. You are also concerned, however, with that more abstract and vague matter we refer to as leadership. The essence of supervision is not technical or engineering proficiency, but skill in coordinating, utilizing and developing people. Management problems are problems of people, not problems of machines and markets.

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In order to coordinate people, we must know something about them. First of all, it is important to realize that all people are different. There is no one yardstick by which we can measure people. Successful supervisors are interested in people. They take the time to study each of their men and come up with a picture of their strong qualities and weak qualities. Since they understand the personalities of their subordinates, they can lead them effectively.

By and large, the most important thing that subordinates expect from



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Radii must be  
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equal



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square sides

Valenite **MICRODEX** inserts are ground by an exclusive new method to give you the most accurate inserts obtainable.

**TRUE RADIUS TANGENCY** — Corner radii must be truly tangent to the sides. If not, the insert will cut on a sharp point. This reduces insert wear life and makes for a poor part finish.



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## tech digests

supervisors is some form of guidance or direction. They realize they have some work to do and they expect to be told what it is. They expect to be told simply and plainly what they are to do and how they are to do it, when they are to have it done, and, most important, how it ties in with other aspects of the job. There are few things that will kill a man's interest in his work more than knowing only what his specific assignment is. When he knows only that he is to do a certain thing in a certain way, his work becomes routine, monotonous and uninteresting. Subordinates also expect to be treated with consideration and respect, and to have their supervisors show some interest in them.

To look at the supervisor from above, management expects all levels of supervision to take full and complete responsibility for the handling of their immediate units. The supervisor is expected to know his department and his people, and is expected to handle them efficiently. He is also expected to train and develop his people so that a replacement is available if he is advanced one notch up in the organization.

Supervision, it can be seen, is an art and a skill. It is not a technique. It is the art and skill of getting to understand how the other man looks at things. What any one of us does in regard to any particular situation depends on how we understand that situation.

From a talk given at the University of Wisconsin Engineering Institute on Drafting Education, University of Wisconsin, Milwaukee, Wisconsin.



## Welded Structures Improved by Forging

By **W. Wollering**

and

**E. Lundby**

Ladish Co.

Cudahy, Wis.

One of the disadvantages of welded structures, from a design standpoint, is that the mechanical properties of welded sections are not the same as properties of the parent metal. For instance, dynamically stressed wrought parts forged from alloys such as SAE 4340, heat treated to hardness levels resulting in ultimate tensile strengths approaching 150,000 psi, have ductility values of approximately 20 percent

**The Tool Engineer**

elongation and 55 percent reduction of area. However, sections in the same alloys, welded with electrodes having properties similar to the parent metal, and heat treated to the same ultimate strength, will disclose ductility values substantially inferior to the wrought parent metal.

To utilize the forging and welding processes to the fullest advantage in higher-strength alloy components subjected to dynamic stresses, it therefore is necessary to improve the ductility of the weld material. Experiments at Ladish Co. have shown that weld material ductility can be improved by heating the welded structure to a temperature in the plastic range and subjecting the structure to a hot forging operation. Excellent results have been obtained with both the submerged arc process and flash butt welding.

As a consequence of this development, design value factors can be increased. The process permits the production of integrally forged geometric shapes which cannot be produced by conventional forging. Also, weld metals with compositions identical to the parent metal can be used. Previously, this was not possible because the elongation values of the weld metals, after welding, were substantially lower than those of the parent metal.

From a paper presented at a meeting of the Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

## Trends in Quality Control

By **Lawrence R. Hafstad**

VP in charge of Research  
General Motors Corp.  
Detroit, Mich.

Quality control has become a specialized profession but engineering management has been slow to pick it up. The reason is that engineers flatter themselves that they can avoid variability. They insist they can make things so uniform they don't have to worry about distributions. One reason for the difficulty of selling mathematical statistics to management is that the people who use it are inclined to consider it as a skill or a ritual. This makes management suspicious. People who are operating in this field should learn to carry out the ritual in private and translate both the assumptions, arguments and conclusions into plain Eng-

lish so ordinary people with common sense can understand it.

Much of the impetus for quality control in recent days has been given by the complexity of modern technical devices, particularly military. Quality control is much concerned with reliability and performance. It is necessary to distinguish carefully between them and realize that performance is something that can be measured but reliability is something that must be predicted.

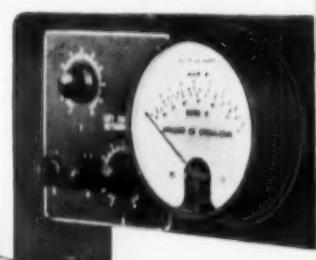
The question of when processes go out of tolerances is not fully understood.

Here is a place where operations research must be brought into the picture—to figure out an optimum sampling system so that the most information can be secured with the least possible expenditure of effort and dollars.

Also, it is the job of quality control to move on into systems analysis. Here people trained in statistics have a real advantage over those not trained because the problem is one of dealing with many variables at the same time.

One may ask why it is so difficult to get sufficient attention paid to reli-

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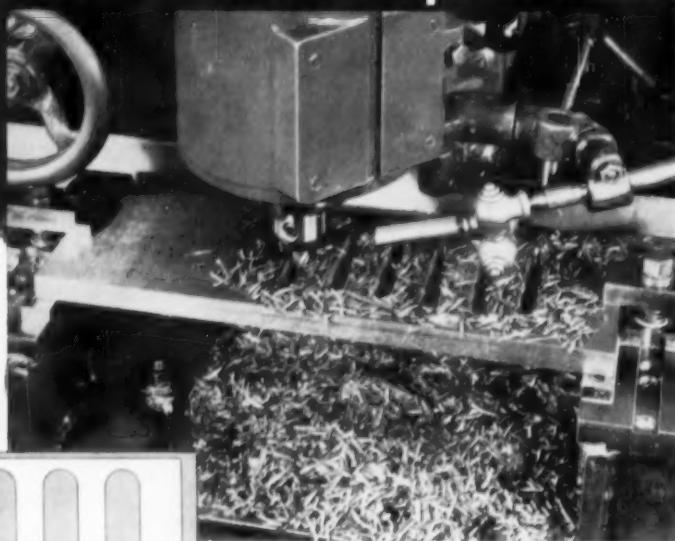
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### tech digests

bility and the development of components. One can cite the fact that as a complicated mechanism such as airplanes or guided missiles, is made, only a fraction of the output is good.

Reliability studies and the team approach could greatly increase the number of good units produced. It is difficult to get money to pay for reliability teams. Why is this? It seems that eliminating failures should be as valuable as increasing production. Thus, the reliability team is producing just as much as the assemblers.

There is another area that industrial engineers will have to move on into. This is the field of economics. As management moves into this field, engineers with a background in statistics and statisticians with a background in engineering have great contributions to make.

In this broadening out process, there are a number of questions that must be asked. For instance, what are the economic, social and political implications in referring to the gain and productivity that the technological society

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produces as "labor productivity." Economists use the term "labor productivity" to cover something that involves several terms rather than a single one. This has serious implications for the supply of scientists and engineers and for the industrial future.

This again raises the question of what are the economic implications of calling the work of quality control people and reliability people and engineers nonproductive labor? How does it happen that an engineer who produces a machine that increases the efficiency of labor and enables it to accomplish more with the same amount of human effort, is doing nonproductive work?

This discussion indicates some of the many opportunities and responsibilities that go well beyond the immediate field of specialization. The adventure and excitement, the creative satisfaction and fun of research consists mainly in moving into new and unexplored territory.

From a paper given before the annual meeting of the American Society for Quality Control, 161 W. Wisconsin Ave., Milwaukee 3, Wisc.

The Tool Engineer

## Automation for Small Manufacturers

By Nicholas Marchak

Director of Resch. and Engrg.  
Sun Tube Corp.  
Hillside, N. J.

Although a small firm, Sun Tube has one of the highest rates of production, as well as an excellent standard of quality in the manufacture of collapsible tubes. Management was aware that many competitors were approaching the standards established and that it would be necessary to start moves for advancement of production practices. In order to keep the high position in the field, expansion of facilities was necessary and it was felt automation would certainly help.

The type of product manufactured is one that lends itself to an automation program. During two-thirds of the production flow, tubes are wet either with enamels or printing inks and must be handled with extreme care. Also the collapsible tube is a very fragile item. It has a relatively thin wall of approximately 0.005 inch and can be dented easily. Human handling has resulted in a sizable amount of scrap in the past.

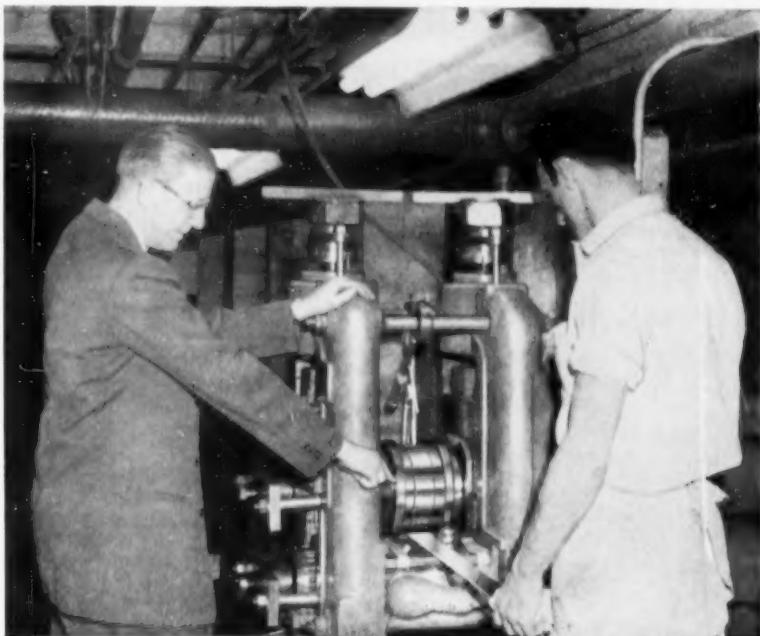
In the production line, geared to a rate of 58 to 60 tubes per minute, at each individual station, such as trimming, coating and printing, it was necessary for the operator to remove a tube from the spindle and place it on a peg chain conveyor. This type of motion and the large number of cycles per day was a painstaking and monotonous process.

After receiving Management's decision to proceed with an automation program, the Engineering Division had to set up specifications for the unit cost and speeds. The study centered around an attempt to increase the speed of the line with a system that would eliminate the great amount of transfer from process to process that presently takes place.

Method studies indicated that removal of tubes from spindles caused a major portion of scrap. Attempts were made to fabricate fixtures for means of tube removal from spindles. Air was found to show great promise. The overall study indicated the entire program of line automation could be accomplished for under \$20,000. This met management approval and the program was under way.

The transferring unit is simplicity itself and can easily be maintained by regular mechanics. Very little debugging was required on the first unit.

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Cold rolling of critical heat resisting alloy stator vanes at D.E. Makepeace Company, Attleboro, Mass.

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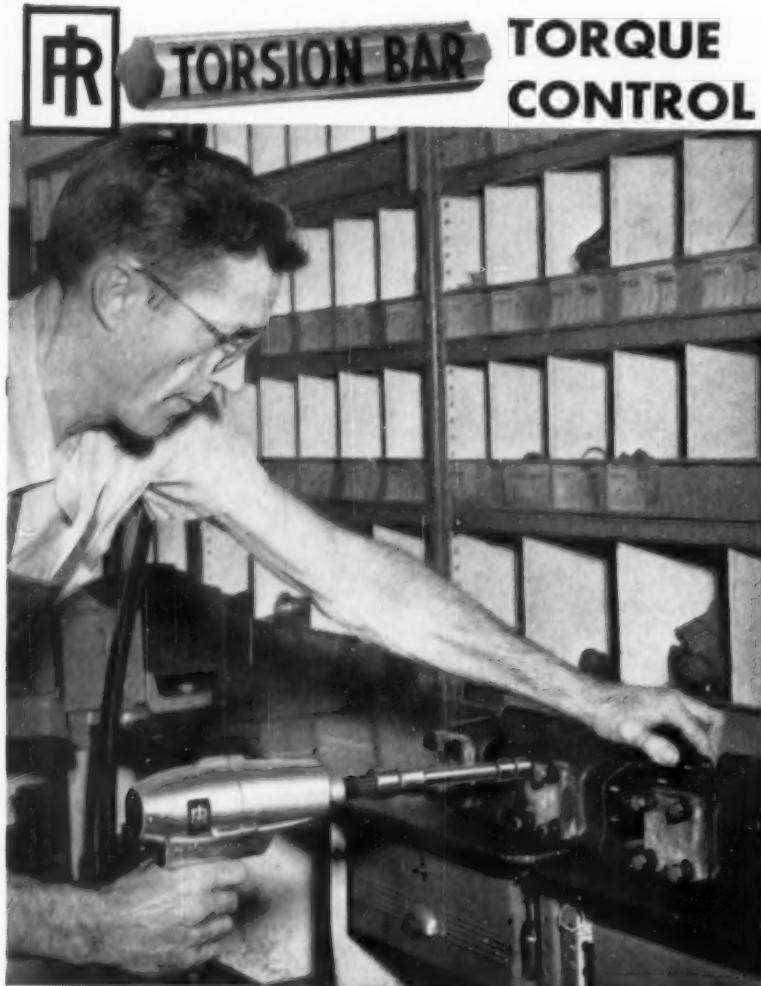
As a result of joint investigations, design changes were recommended and adopted. The result? Roll life was multiplied.

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### tech digests

Operators were retained to detect false feeds, jam-ups and to check the unit for areas of breakdown.

As a result of automation, all elements of the business, the employee, the customer and the stockholder have benefited. Experience with this program causes the firm to look to the future with extreme confidence.

From a paper given at a special conference on the Factory of the Future, Cleveland, Ohio, sponsored by American Management Assn., 1515 Broadway, Times Square, New York 36.



### Nuclear Techniques for Study of Surface Coatings

By O. Kenton Neville

Tech. Dir.  
Nuclear Instrument and Chemical Corp.,  
Chicago 10, Ill.

Internal thickness gaging is a relatively little used technique which is of great potential importance in product research and testing. In ordinary thickness or density gaging, the beta or gamma rays, produced in a fixed external source of constant radioactivity, are allowed to pass through the material being tested and are measured with a detector. The diminution of the number of particles or rays is a function of the thickness and density of the material. Although the method works well with sheets of homogeneous material, it is seriously impaired in the determination of the thickness of a film or coating of one material on another.

Many of these latter cases can be handled readily by the use of internal thickness gaging in which a radioisotope is incorporated in the surface of the material on which the coating is to be placed. A determination of the surface radioactivity before and after application of the film gives the thickness of the coating. The subsequent rate of removal of the coating as a function of abrasion, solution, weathering, etc., may be easily studied by making successive measurements of the surface radioactivity during the course of the treatment. Examples of the technique are the determination of the thickness of engine deposits as a function of fuel composition, the thickness of boiler scale buildup per unit time, etc. In all of these cases, a low-energy beta emitting isotope such as nickel-63 or carbon-14 was incorporated in the surface of the foundation.

In addition to these numerical data,

**The Tool Engineer**

X-ray type photographs of the film may be taken by simply laying an X-ray film on the surface. The developed photograph shows the uniformity of the coating and reveals pits, checks and bubbles that may not be visible on the surface.

The techniques of internal thickness gaging should be of interest to research, development and testing groups in all industries dealing with surface coatings, platings, depositions and films. The techniques are simple and straightforward and require minimum radioisotope experience and instrumentation.

From a paper given before the Annual Conference on Atomic Energy in Industry, March 1957, sponsored by National Industrial Conference Board, 460 Park Ave., New York 22, N. Y.

▼ ▼ ▼

## Developing Metals for the Future

By Robert C. Bertossa

Research Metallurgist  
Stanford Research Institute  
Menlo Park, Calif.

Research investment in the field of vacuum-melting, joining and heat treating can be expected to reap rich rewards in industrial and process development in the future. A number of industries have already solved important problems by the use of vacuum metallurgy.

In one case, a manufacturer found that the only satisfactory materials for tanks holding certain corrosive chemicals were gold, silver or platinum. Since the tanks were 30 feet in diameter, use of these precious metals was impractical. By using vacuum metallurgy, however, it was possible for the first time to successfully coat the inside of a steel tank with a thin layer of silver, thereby solving the problem at reasonable cost.

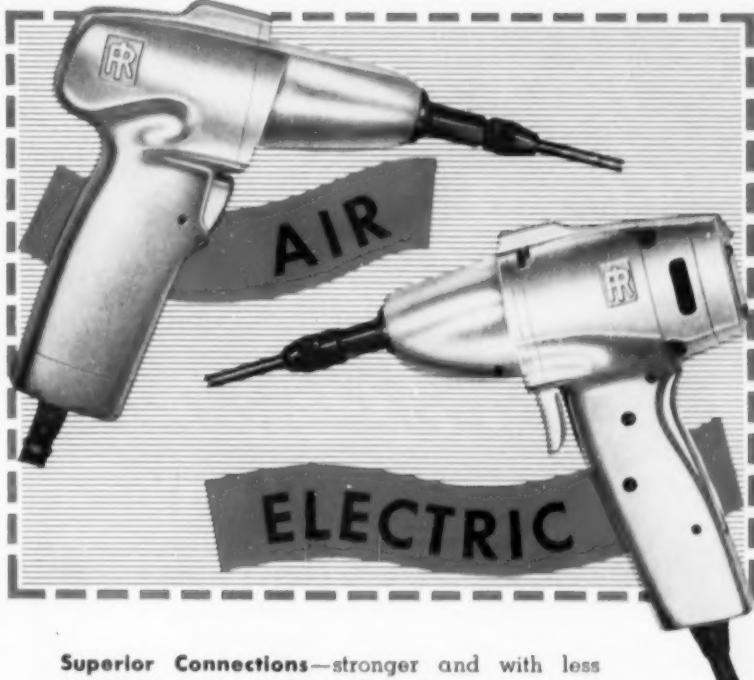
Other commercially important applications have been found in producing, for nuclear power plants, metals that will withstand the corrosive effects of atomic radiation. Among the processes which can be performed under a vacuum are heating, melting, cladding, brazing, casting, purification and heat treating.

From a paper presented at a meeting of the American Society of Mechanical Engineers, 29 West 39th Street, New York 18, N. Y.

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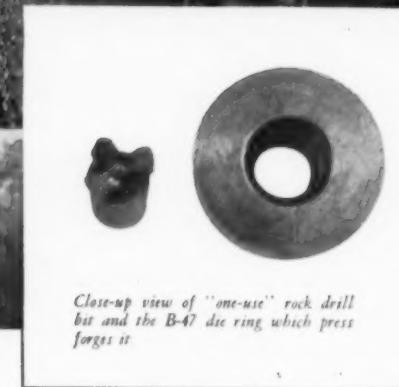
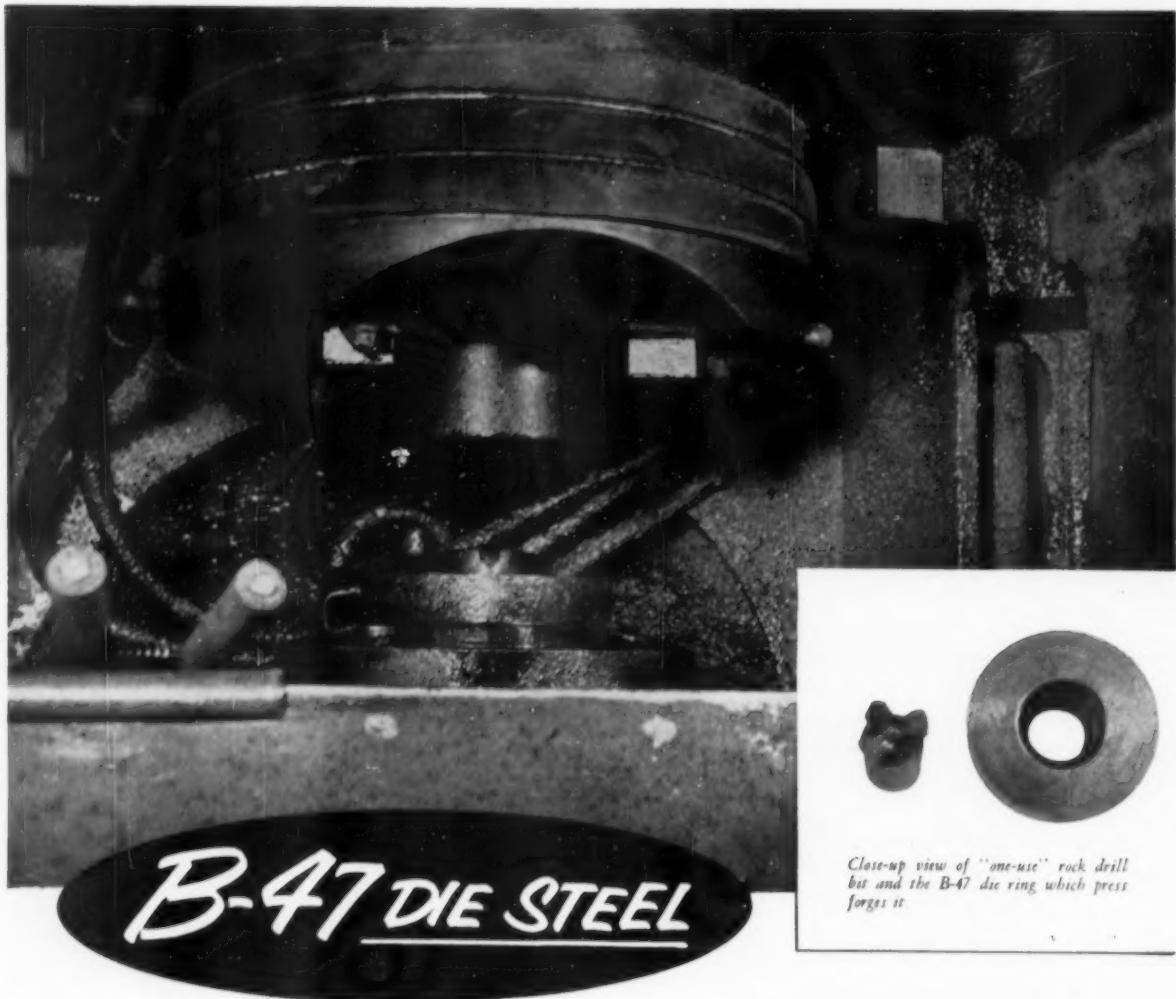
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*Close-up view of "one-use" rock drill bit and the B-47 die ring which press forges it.*

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A midwestern company increased their production of rock drill bits from 1500-3000 per die ring to a consistent total of more than 10,000 bits by switching to Allegheny Ludlum's B-47 die steel.

But of even greater importance, they claim, is the dependability of B-47:

"The less breakdowns we have, the less die changes we must make and the better production we get. Also, we are able to plan our production on the basis of being sure of the reliability of our dies."

Continued high production is necessary to make these special "one-use" bits com-

petitive in today's market. B-47 practically eliminates unscheduled downtime caused by die failure.

A-L's B-47 is a tough hot work steel. It has excellent resistance to shock and abrasion at elevated temperatures. Also, it is especially good for those applications which require ruggedness at relatively high hardnesses.

Check your A-L representative today about Allegheny Ludlum's complete line of tool and die steels—a grade for every job. *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh, Pa.*

For nearest representative, consult Yellow Section of your telephone book.

For complete MODERN Tooling, call  
**Allegheny Ludlum**



W.W. 6649

# MAN AT WORK! MAKING MONEY!

"in the production of  
special precision  
parts..."

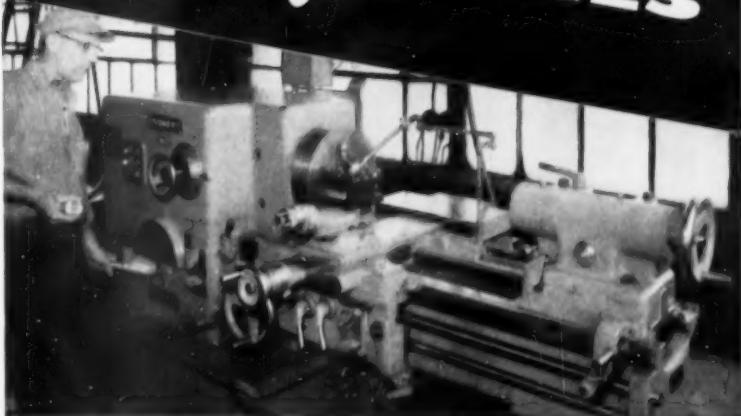
**HENRY VOGT MACHINE CO.**  
LOUISVILLE, KY.

depend on

**SIDNEY** *Heavy-Duty* **LATHES**

The scales turn in favor of SIDNEY HEAVY DUTY LATHES on any type of work . . . turning standardized "mass production" work in impressive quantities . . . or turning special precision parts, as illustrated in this photograph. Henry Vogt Machine Co. makes forged steel valves and fittings, water tube boilers, refrigerating machinery and other equipment.

The type or quantity of work doesn't phase these lathes . . . it's all part of the "cost-less, produce-more" story.



## AUTOMATIC, HYDRAULIC DIAL CONTROLLED CHANGE 32 SELECTIVE SPINDLE SPEEDS IN GEOMETRIC PROGRESSION

—one of the many Sidney "firsts" which have been making history as far back as 1947.

**SIDNEY LATHES** are precision tools, designed for rigidity, accuracy and dependability, regardless of the severity of the operation performed. Exceptionally smooth and quiet. A size and speed available for your plant.

Write for bulletins or for representative to call at your convenience.

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Builders of Precision Machinery since 1904

# specify screws with lowest lifetime cost



*Here's a cost-saving tip—don't specify or buy screws on first cost alone. Evaluate the lifetime cost—it can mean substantial cost savings.*

For applications requiring utmost strength and dependability, Mac-it Socket Screws have the lowest lifetime cost. This can save you money through:

**LESS DOWNTIME**—production interruptions from screw failures are expensive. Screw costs are negligible when compared to the costs of (1) lost production, (2) idle operators, (3) repair crews, (4) replacement parts and (5) delayed shipments.

**FEWER REPLACEMENTS**—because of Mac-it's longer life.

**BETTER PERFORMANCE**—because of Mac-it's greater resistance to punishment.

**GREATER SAFETY**—because of Mac-it's resistance to failure.

For screws that cost less in the long run, specify Mac-it—for original equipment and replacement parts. You will find the complete line of Mac-it Hex Socket and Alloy Cap & Set Screws at your local Mac-it distributor, or write: Mac-it Screw Division, Strong, Carlisle & Hammond, 1392 West 3rd Street, Cleveland 13, Ohio.

**MAC-IT** hex socket  
alloy cap & set → **SCREWS**

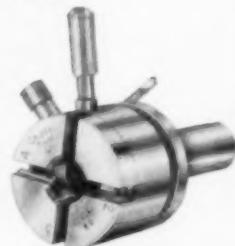
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224

## CUTTING and CHASING THREADS?

CHASO'S chasers and self opening die heads offer the fast economical way to do production threading.

CHASO manufactures all types of chasers including tangent, circular and radial in both cut thread and ground thread for most makes of die heads. Solid adjustable taps and chaser sharpening fixtures are also available.



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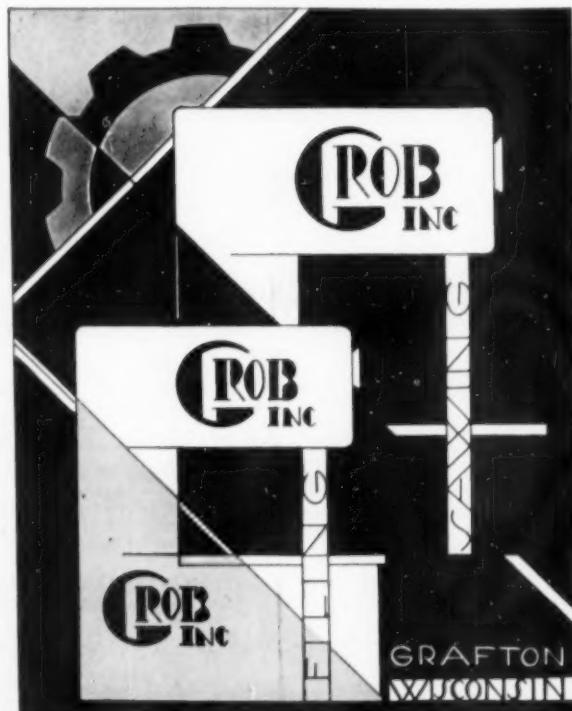


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MANUFACTURING CHASERS  
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The Tool Engineer

# A NEW AID FOR COST-CONSCIOUS MANAGEMENT

You can now determine just how much productivity you are losing because one or more elements of the operating cycle of an automated machine are not perfectly timed.

Now you can spot any timing error to within a 60th of a second immediately.

## Cycle Analysis

Sheffield's new Monitorecord\* system analyzes timing by means of a printed, composite time graph. This shows every start, dwell and stop of each interrelated event in the complex machine cycle — just as it occurs.

## Corrective Adjustment

When a Coded Master is laid over the time graph you see just what adjustments are needed and the amount of each. No tedious groping — no costly down-time.

What could serve Preventive Maintenance more effectively than taking such a graph every day? What could save as much set-up time? This system often justifies its cost the first time it is used.

System installation is no problem. It can be applied to machines now in service or it may be built into new machines.

The readily portable Monitorecord is merely plugged into the system receptacle of any machine requiring cycle analysis. It can be moved about at will.

Get all the facts on this profit-conserving idea. Write to the *Sheffield Corporation*, Dayton 1, Ohio, U.S.A., Dept. 19.



**the SHEFFIELD corporation**  
monitormatic and measurement for mankind

\*Trademark

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by **SOSSNER**



#### How "elektraLUBE" Works:

High pressures of A and B force out conventional lubricant. "elektraLUBE" takes over at these critical points and provides permanent super-lubrication.

**E** The "elektraLUBE" process imparts a thin ductile deposit which acts as a permanent super-lubricant...Not obtained by conventional plating...Not subject to chipping or peeling. Under working pressures the deposit imbeds itself into the microscopic pores of the ground tap, resulting in a smooth burnished surface. Reduces torque up to 25%...Freedom from "pickup", "loading", "welding", and "galling"...smoother threads in the workpiece.

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a standard with SOSSNER delivers FULL VALUE



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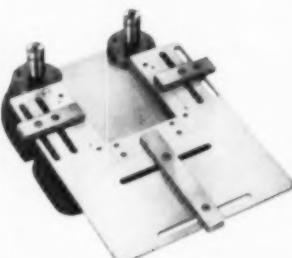
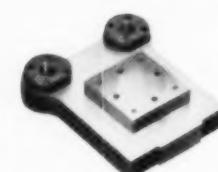
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### Notching Die with Gauge Table



Standard stock sizes 4", 5" and 6". Lick those Notching Problems QUICKLY. Gauge table and gauging bars provide accuracy and speed with easy adjustment.



This is another of the many different kinds of punches and dies in stock or made to order for foot, hand or power operation. Precision made from high grade tool steel. Also adaptors and die shoes to convert your press.



What are your punch and die needs? Consult us about your problems. Prompt service on "Specials" made to your order.

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**WARD Machinery Co.** 564 West Washington Chicago 6

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TO OBTAIN FURTHER INFORMATION ABOUT ADVERTISERS, TRADE LITERATURE OR TOOLS OF TODAY APPEARING IN THIS ISSUE OF THE TOOL ENGINEER, USE THE HANDY READERS SERVICE CARD ON PAGE 175.

# GEARED to move mountains of earth!



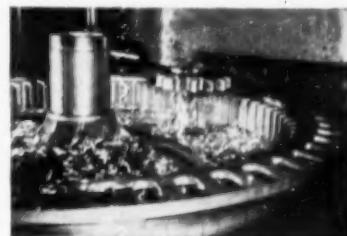
**S**harp curves and steep grades used to be a part of almost any highway trip. But after the great new highway programs are completed, you will be able to travel nearly everywhere in our country with a greater degree of safety and comfort. Giant construction machines will move mountains of earth in building the sweeping scenic roads that will make up our national highway system.

Gears cut on Fellows Gear Shapers are important components of the machines that perform this herculean task. In an earthmover, for example, many tons of force must be transmitted smoothly and without failure. Often these heavy duty gears must be of large diameter and coarse pitch.\* In any case, there are

Fellows machines that can produce them accurately and rapidly.

Your own gear production needs, from 1/16" to 120" pitch diameter, can very likely be met more profitably and efficiently with Fellows Gear Production Equipment. For information about the complete Fellows line, write, wire, or phone any Fellows office.

\*For example, The Shovel Company of Lorain, Ohio produces this 73 tooth, 1.8235 D.P. internal gear on a standard Fellows 100-inch Gear Shaper. Gear is used in Lorain shovels and cranes.



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THE  
PRECISION  
LINE

# Fellows

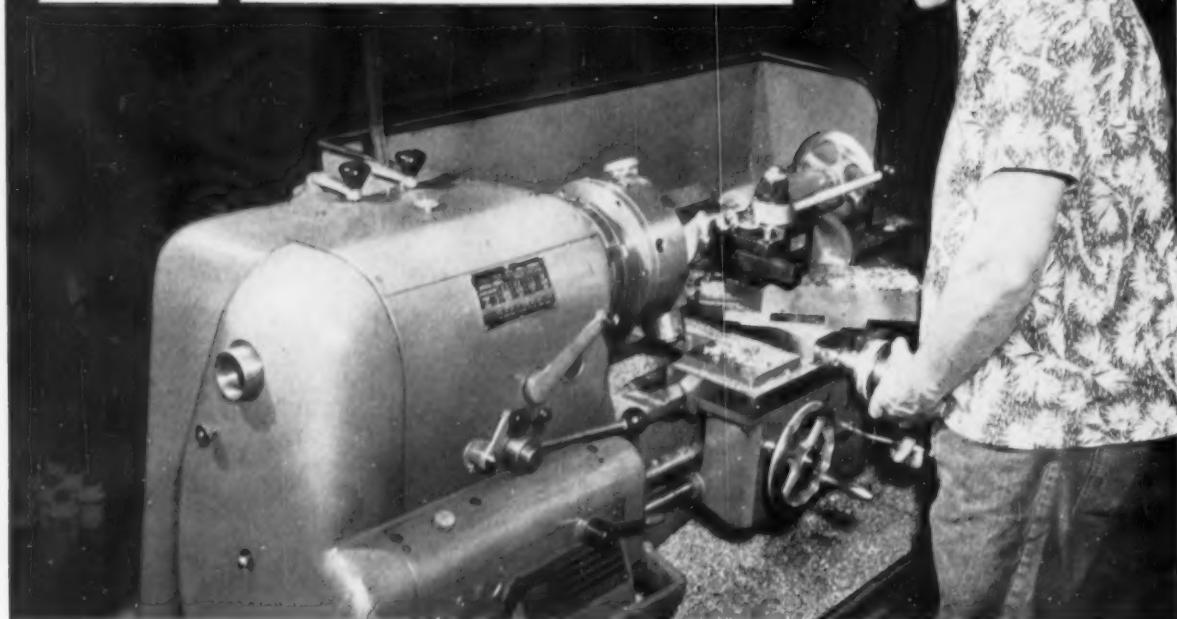
Gear Production Equipment



"We like everything about our Clausing lathes. The spindle capacity, 'beef' of the machine, and ease of operation are impressive. The finish we get is phenomenal. And, you just can't beat Clausing geared-head lathes for value!"

— Ronningen Manufacturing Co.

Operation illustrated: One-inch diameter plunge cut in a 6" diameter brass casting. (left). Stock removed is .100". Finish, "phenomenal."



## Performance records PROVE **CLAUSING LATHES'** Superior Construction... Greater Value

The statement of Ronningen Manufacturing Company above is typical — users everywhere report Clausing geared-head lathes lead their field in capacity, performance and value. Here's why:

**They're bigger in capacity** than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. (See chart at right.) Geared-head drive is powered by one or two speed motor thru multiple V-belts.

**Have heavy-duty construction** throughout. Beds are 50% steel, 50% iron with elliptical cross ribbing — ways are induction hardened and precision ground. Gears in head and quick-change box run in bath of oil — gear shafts are multi-splined. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile hammered steel forgings — note size. Note, too, the heavy-duty construction of tailstock and double-walled apron.

**Built for precision performance** — to American standards of toolroom lathe accuracy. Gamet Micron tapered roller bearings with oil flow lubrication — the most advanced and accurate bearings known to industry. And each Clausing lathe passes rigid tolerance tests before it leaves the factory.

*Each is an outstanding value. 13" cabinet base models, including motor and controls, start at \$1952; 15" cabinet base at \$2744; 17" at \$4345. You owe it to yourself to investigate before investing in any lathe.*

### LATHES CAPACITIES

Lathe	17"	15"	13"
Thru-Hole	3-1/16"	2-1/16"	1-9/16"
Nose Taper Key Drive	L-2	L-1	L-0

### BEARINGS

Lathe	17"	15"	13"
Front Spindle Bearing O.D.	7-1/2"	5-1/2"	4"
Rear Spindle Bearing O.D.	6"	4-3/8"	3-9/16"

# CLAUSING DIVISION

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by ROGER PRICE



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Floor Model FC-14



## "LEFT-HANDED MONKEY WENCH"

Her name was Yvonne, and I won her in a crap game in Greenwich Village. She was a winsome little thing, and at first we got along famously. She was a good housekeeper, and her cooking wasn't half bad, if you like a steady diet of banana fritters, banana bread and banana pudding. Some people would call Yvonne talented, I suppose, but frankly, she had lots of faults, too, like singing off-key, and lacing my beef stew with absinthe. Finally, when she started nagging me and sneering at my sparkling witticisms, I got fed up and gave her to my worst enemy. Now they're both on TV, making a fortune, and I'm back doing my own typing again.

Without monkeying around any further, I'd like to give you a few facts on Jones & Lamson Optical Comparators. These precision-built instruments are on the job throughout industry, keeping quality control high by rapidly and accurately measuring and inspecting all sorts of parts and objects. The J & L Comparator's speed, accuracy (to  $.0001''$ ) and ease of operation make it equally valuable for both production line and small-lot work. Investigate how the J & L Comparator can help keep production quality high, and scrap low, in your plant. Available in eleven bench and floor models. For complete information, write Dept. 710 today.

## JONES & LAMSON OPTICAL COMPARATORS On the Job . . .



### at New Milford Carbide Tool Co., Hackensack, N.J.

J & L Comparators speedily and accurately check angles, radii, contours and linear dimensions of precision carbide and H.S.S. form tools, thereby assuring conformance with specific customer requirements.



### at American Coldset Co., Paterson, N. J.

The rapid, precise inspection of special and standard industrial diamonds, by means of J & L Optical Comparators, safeguards the maintenance of high quality standards.

"The originator of machine tool standards in optical inspection"

# JONES & LAMSON

JONES & LAMSON MACHINE COMPANY, Dept. 710, 518 Clinton Street, Springfield, Vt., U.S.A.

Please send me Comparator Catalog 5700, which describes the complete line of J & L Optical Comparators.

name

title

street

company

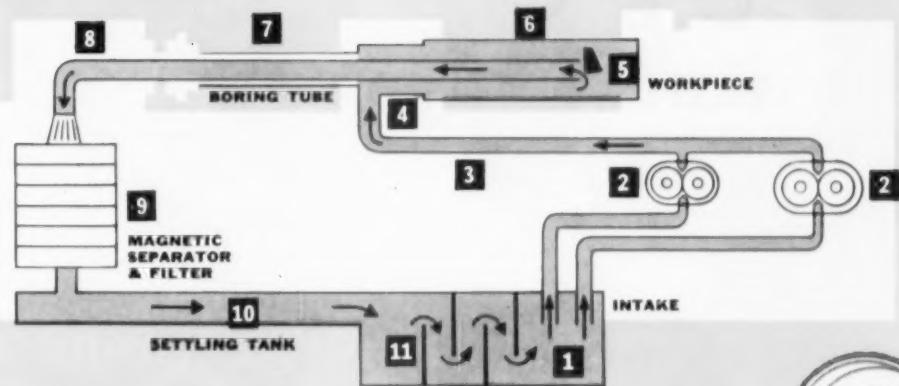
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Tools for drilling, trepanning and boring developed and patented by Heller.



In consecutive order, the numbers show the path of Shell Garia Oil 115 through a typical boring machine.



BORING AND TREPANNING  
ASSOCIATION

## Revolutionary new rapid boring tools last 50% longer with Shell Garia Oil 115

American Heller Corporation is introducing to the U.S.A. new tools for extremely high-speed boring, trepanning and drilling of deep holes. These precision tools offer the double advantage of high-speed accuracy and excellent finish.

Used in conjunction with suitable boring machines, the tools make use of this new technique:

*Cutting oil is forced between the boring bar and wall of stock, forming a*

*continuous bearing. The oil is forced back through the hollow boring bar, carrying away the chips as it goes. Tool faces are kept clean and chip passage clear. Chips do not come in contact with finished bore. This insures greater accuracy at higher speeds and feeds than ever before possible.*

This operation required a cutting oil with extreme pressure and excellent cooling characteristics. Working with Heller, Shell engineers developed

Garia® Oil 115. Experience with the new cutting oil has proved that tool life is increased 50% over conventional drilling or cutting oils. Garia Oil 115 is approved and recommended by the Boring and Trepanning Association.

For more information on Shell Garia Oil 115, write to Shell Oil Company, 50 West 50th Street, New York 20, N. Y., or 100 Bush Street, San Francisco 6, California.

**SHELL GARIA OIL 115**



If you want to PRODUCE MORE

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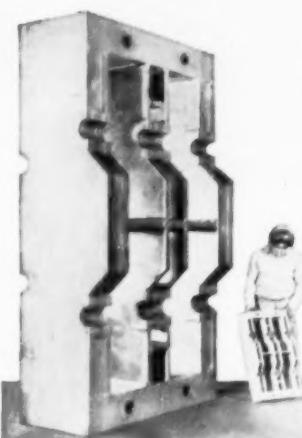
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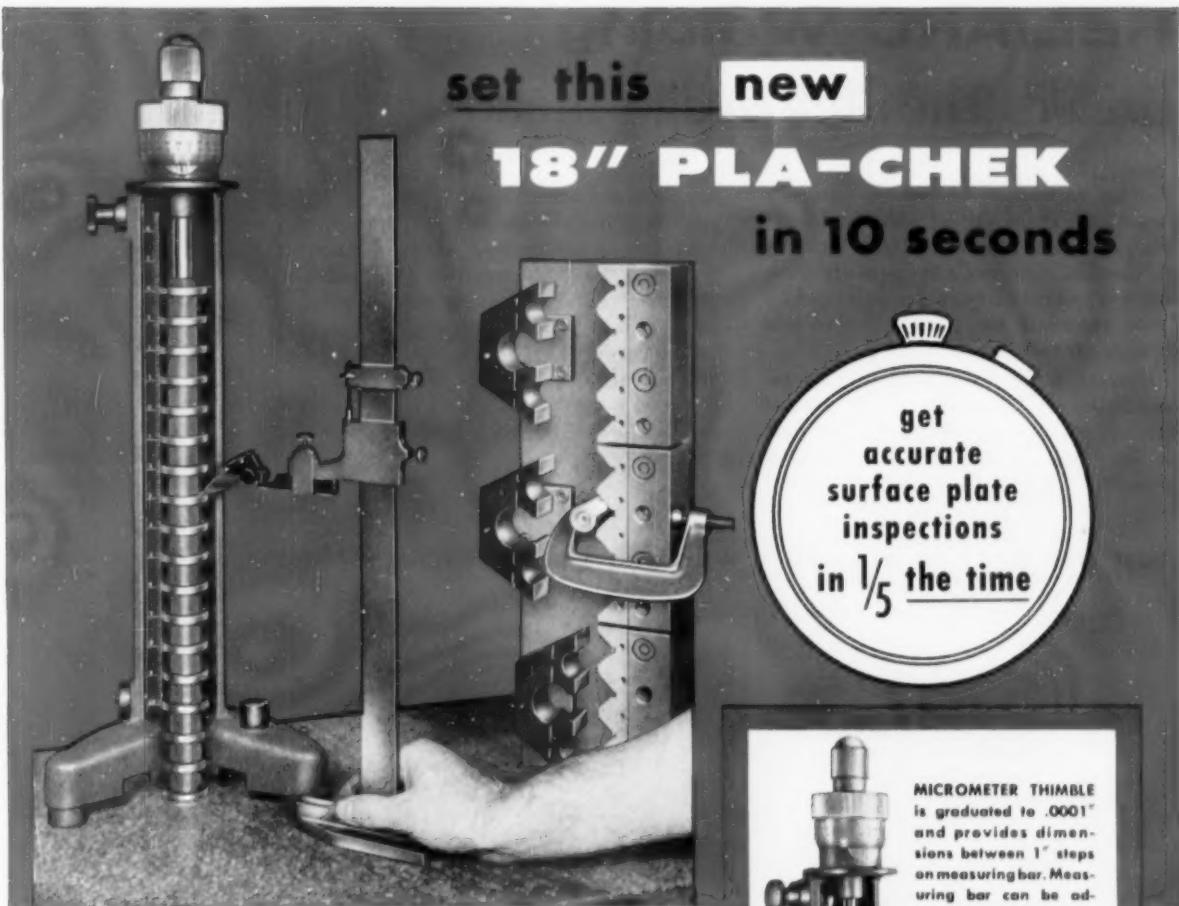
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Cadillac PLA-CHEK GAGES are available in a complete range of sizes: 6", 12", 18", 24", 36", and 48" models. Precision-made risers, increasing the range of each model, are also available.

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# HELIARC Welding

## breaks the light-gage metal barrier

Welding stainless steel sheet into a smooth, streamlined shape for jet plane fuel tanks is a production job for HELIARC Welding. This method, utilizing a tungsten electrode shielded by LINDE Argon, was developed by LINDE especially for use on hard-to-weld commercial metals.

HELIARC Welding can be used either automatically or manually, in all manual welding positions. LINDE Argon in bulk or in cylinders—99.99% pure—protects the weld. Since no flux is required, joints

are clean and smooth, without spatter, saving you time and money.

Get more information about HELIARC Welding. For a free copy of the booklet, "Modern Methods of Joining Metals," write Dept. TE-11, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. *In Canada*: Linde Company, Division of Union Carbide Canada Limited.

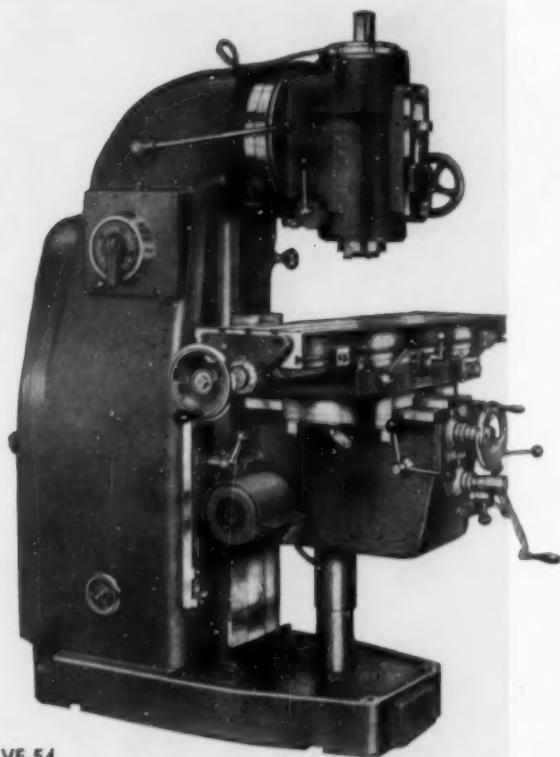


Fuel tanks for jet planes, made of thin stainless steel, are quickly assembled with smooth, clean and sound seams by HELIARC Welding, a LINDE development.

**FOR THE BEST IN ELECTRIC WELDING—LOOK TO LINDE!**



The terms "Linde," "Heliarc," and "Union Carbide" are registered trade-marks of Union Carbide Corporation.



VF-54

**Standard Duty #2 (Model 54)**  
**ALL GEARED Millers—**

Plain, Universal and Vertical—table 52" x 11", 7½ HP with power feeds (longitudinal 33½") and power rapid traverse.

**Light Duty #2 (Model 53)**  
**ALL GEARED Millers—**

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**Light Duty #2 (Model 48)**  
**Utility Millers—**

Plain and Universal—table 41½" x 9½"—3½ HP with power feeds (longitudinal 24½").

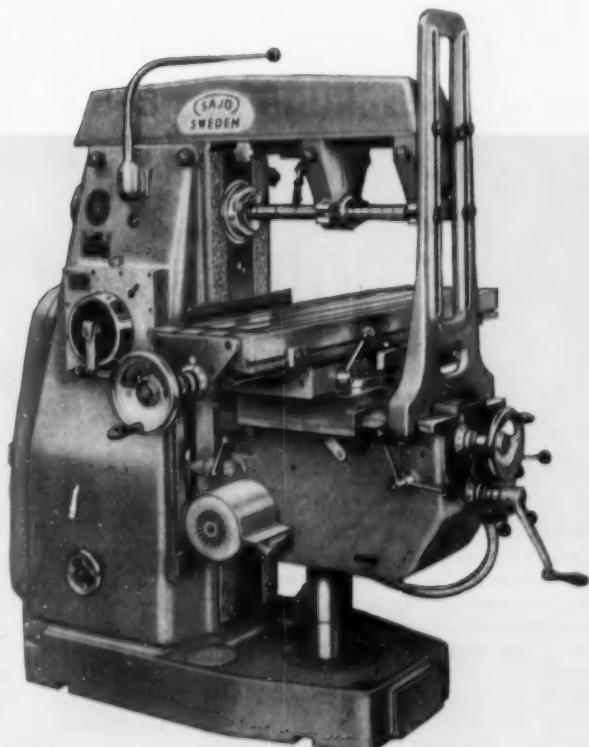
## ONLY SWEDISH CRAFTSMEN

Can Build These Precision Millers  
 At Such Surprisingly Low Cost



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Built to U.S. Standards, Sajo Millers with proven production records in modern industry are available in both plain and universal models. Installation references in your vicinity on request.



PF-54

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HORIZONTAL AND VERTICAL SHAPERS • POWER HACKSAWS

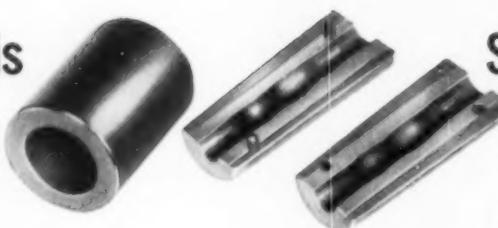
FAST SERVICE AND PARTS AVAILABLE FROM MAJOR CITIES, WRITE FOR CATALOGS

This KENNAMETAL\*



Solid Die

Replaced this



Split Die

in Producing these



Grinding Wheels

## PRODUCTION UPPED 50% ...DIE COSTS PER PIECE CUT 75%

The small abrasive grinding wheels produced by Mounted Points Company, Inc., of Garden City, Michigan, represented a real production problem.

In the operation, aluminum oxide with a clay binder was compacted into parts  $\frac{1}{4}$  inch in diameter, and from  $\frac{3}{4}$  to 1 inch long. Costly split steel dies wedged into a tapered case, on a manually-operated press, had been used. Parts frequently seized, due to wear on the I.D., and could not be removed without opening the die. Even then, breakage was extensive.

From 40 to 50 parts per hour were produced from each die. Because of the extremely abrasive action of the aluminum oxide grits, die life was only 2,000 to 2,500 at which point the die was worn approximately  $\frac{1}{16}$  inch larger in diameter.

The L & H Die & Tool Company, of Oak Park, Michigan, fabricated a solid cylindrical die for the operation. It was made of Kennametal Grade K11, was .260 inch I.D. x  $3\frac{1}{4}$  inches long, and was housed in a  $\frac{1}{2}$ -inch alloy case.

With this die, production jumped to 60-70 parts per hour by eliminating the costly operation of assembly

and disassembly of the tapered steel die for each piece produced; also by virtual elimination of rejects due to jamming. The die with Kennametal produces 15,000 pieces with only .005-inch wear on the I.D. Parts are easily ejected, breakage of product is held to a minimum, and sizes are held more constant. The original grind, plus four regrinds, produced 90,000 pieces. The die was then reworked to produce a grinding point  $\frac{1}{32}$  inch larger.

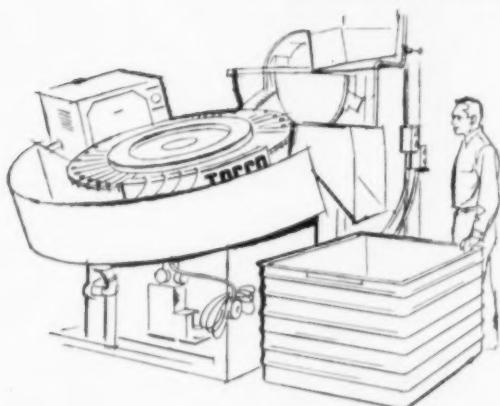
If you have a die application where loads are light, abrasive conditions are severe, and dimensional stability is important, Kennametal Grade K11 may solve your problem. Consult your die supplier, your Kennametal Die Engineer, or write: KENNAMETAL INC., Latrobe, Pennsylvania.

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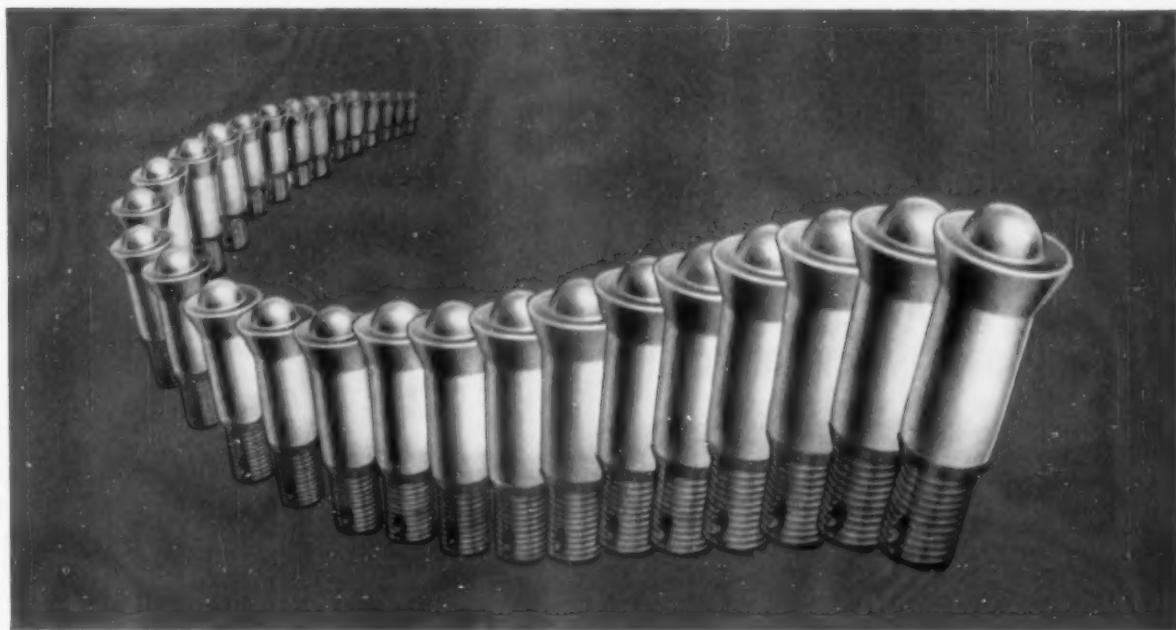
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THOMPSON PRODUCTS ANNEALS THREADS ON BALL STUDS



# ONE A SECOND!

*with TOCCO\* Induction Heating*



**Up Goes Production**—When progressive engineers at Thompson's Michigan Division switched from conventional gas annealing to fully automatic TOCCO for annealing threads on automotive ball studs, production jumped from 2128 to 3226 parts per hour—an increase of over 50%.

Localized TOCCO heating draws threads from 60 to 30 Rockwell C, using 50 kw at a frequency of 10,000 cycles per second.

**Down Go Costs**—While production zoomed, costs dropped sharply with TOCCO annealing—a reduction of 34% in direct labor costs alone. With an average monthly output of 350,000 of these parts, Thompson saves thousands of dollars per year with TOCCO. If you heat metal parts for annealing, forging, brazing or hardening, investigate how TOCCO can up *your* production and lower *your* costs.



THE OHIO CRANKSHAFT COMPANY

Mail Coupon Today—**NEW FREE Bulletin**

The Ohio Crankshaft Co. • Dept. G-11, Cleveland 5, Ohio  
Please send copy of "Typical Results of TOCCO Induction Hardening, Heat-Treating and Annealing".

Name \_\_\_\_\_

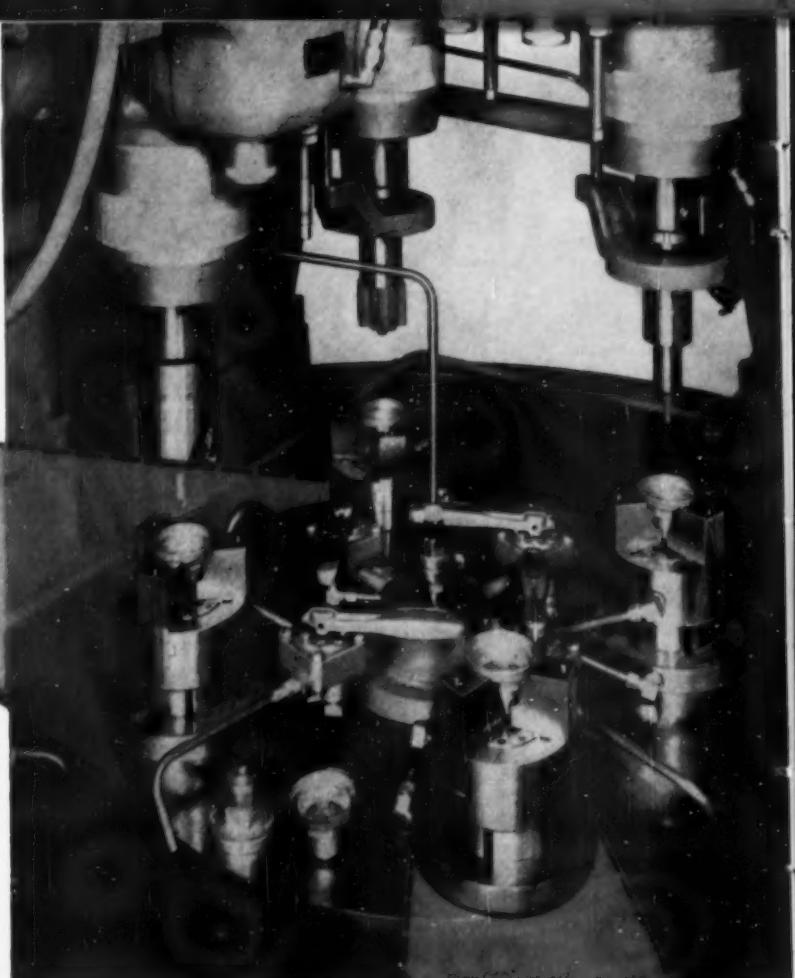
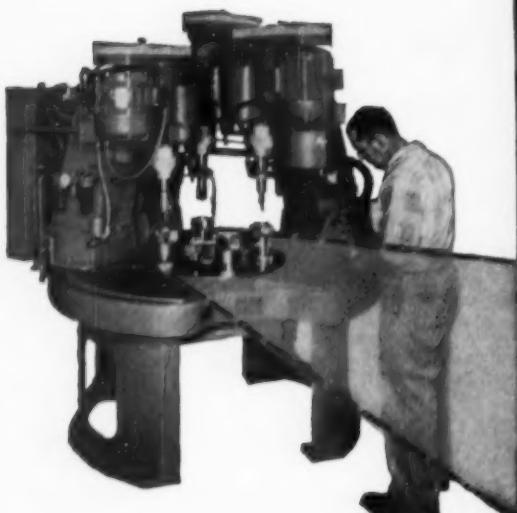
Position \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_

Hartford Special Multi-operation  
Indexing Machine equipped with  
four Skinner Power Chuck Fixtures



**Production increased...  
costs slashed  
with  
Skinner Power Chuck Fixtures**

Four Skinner Power Chuck Fixtures mounted on an index table recently helped Hartford Special Machinery Company develop a low-cost, high-production machine for a customer that assured top quality at a lower part cost.

In this application, each Power Chuck Fixture holds a work piece and is indexed to three working stations for machining.

The operator has only seven seconds to unload and load, yet can keep up the pace all day long, thanks largely to the effortless releasing and gripping of the air-powered fixtures.

Skinner Power Chuck Fixtures are compact, but versatile enough to hold up to 15 sizes of the customer's work pieces, if need be. At the same time, they can be used to grip a wide variety

Non-rotating Skinner Power Chuck Fixtures are ideal for holding work on drilling and milling machines, for assembly operations and for other bench and machine installations.

They're operated by air for fast, effortless loading and unloading. The compact units are available in several sizes, with either two or three adjustable or non-adjustable jaws.

of other work for drilling, machining, or assembly operations.

See how you, too, can profit from the accuracy, speed and strength of Skinner Power Chuck Fixtures. Send for Catalog No. 68P, which gives the details of all Skinner Chucks and Fixtures. Write Dept. 18N.



Skinner Power Chuck Fixtures are available through leading Industrial Distributors everywhere.



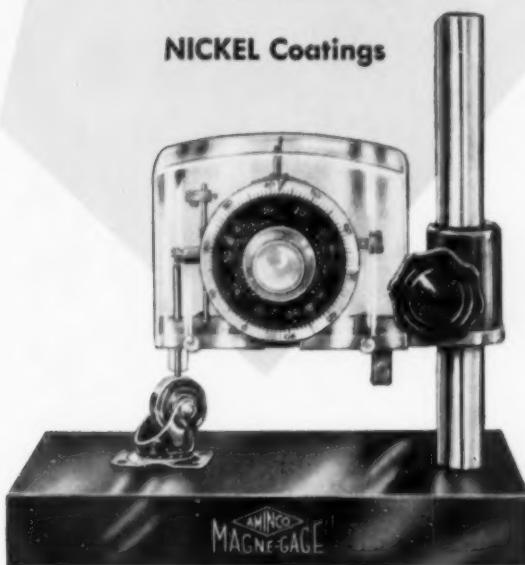
# THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

# Measure Coating Thicknesses ACCURATELY & NON-DESTRUCTIVELY

METAL Coatings on  
IRON, STEEL and  
NICKEL Coatings



## MAGNE-GAGE

The Magne-Gage quickly and accurately measures thickness of coatings such as the following:

1. Nickel coatings up to 0.001 in. thick on non-magnetic base metals, such as copper, brass, and zinc-base diecastings.
2. Polished nickel coatings up to 0.002 in. thick on iron or steel.
3. Non-magnetic coatings up to 0.080 in. thick on iron or steel. Such coatings may be electro-deposited copper, zinc, cadmium, tin or chromium; hot-dipped tin, zinc or lead; non-metallic paint or vitreous enamel.

Instrument is portable—measures curved as well as flat surfaces—accuracy within  $\pm 10\%$ . Complete readings can be made in 45 seconds.

Coatings of  
PAINT, VARNISH, SHELLAC,  
CERAMICS, PLASTICS, ANODIC



## FILMETER

Thickness of non-conducting coatings on non-magnetic base metals (aluminum, duralumin, brass, copper and bronze) are readily measured by the Filmeter. Coatings in this category include paint, varnish, shellac, lacquer, enamel, plastics, and ceramics from 0 to 0.005 in. thick.

The Filmeter measures with an accuracy of  $\pm 3\%$  of full scale. Measurements can be made on flat, concave or convex surfaces.

The instrument will measure anodized films from 0 to 0.001 in. on aluminum, or aluminum alloys in accordance with ASTM Test No. B244-49T.

Device includes an inductor which is placed on the coated surface; a control box, a set of earphones, standard thickness samples, and a calibration chart. The instrument weighs only 11 lb., is battery-operated and fitted with a carrying strap.

### Specified by ASTM For Test 1400-56T

The Filmeter has recently been recommended by the ASTM (American Society for Testing Materials) as the instrument to perform Test No. 1400-56T, "Method for determining the dry-film thickness of non-metallic coatings of paint, varnish, lacquer and related products on a non-magnetic metal base."

Full information for both instruments contained in BULLETIN 2253—H-2, furnished on request



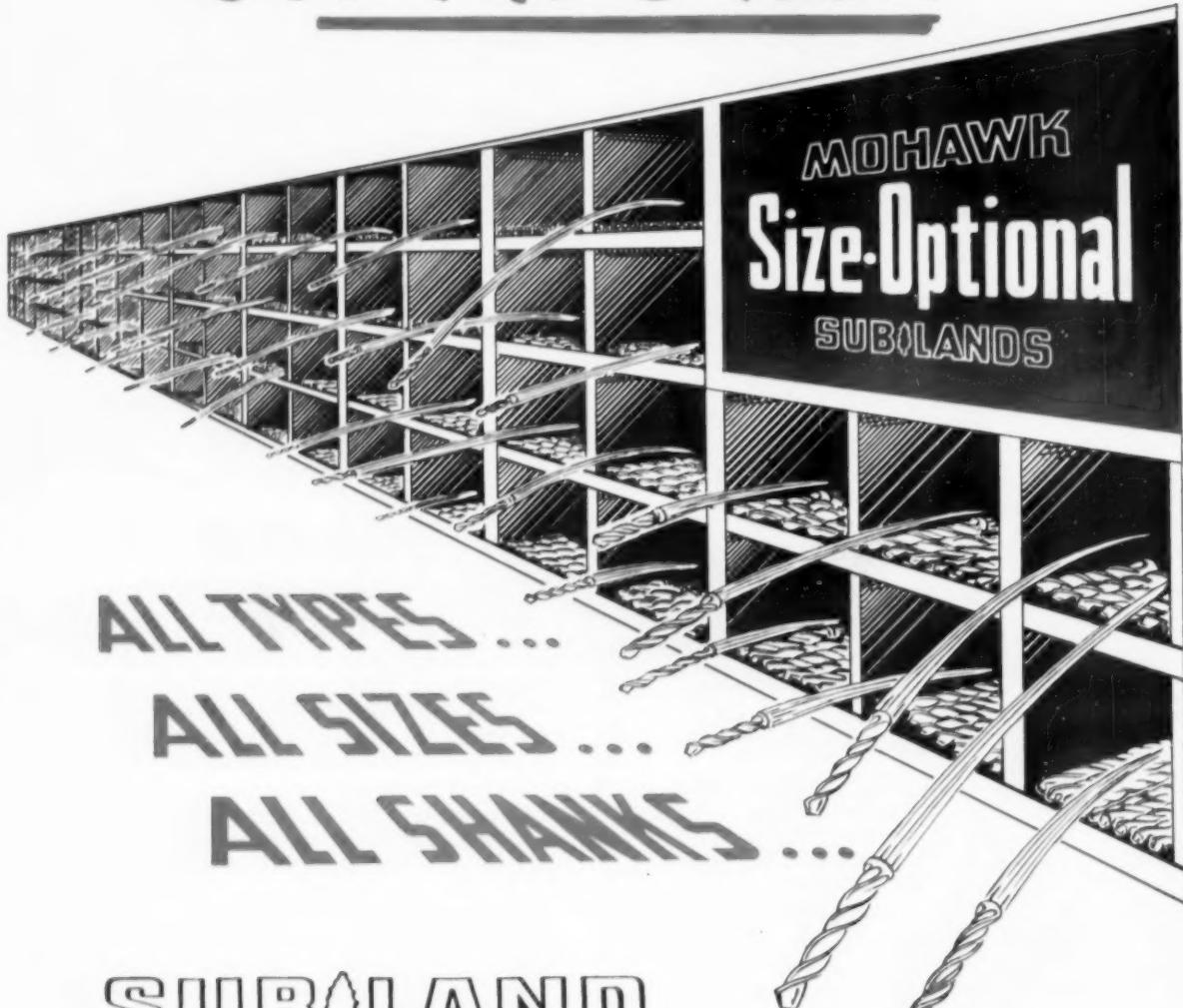
**AMERICAN INSTRUMENT  
COMPANY, INC.**

Silver Spring,  
Maryland

In Metropolitan  
Washington, D. C.

# SUBLANDS

# OFF THE SHELF!



## SUBLAND

- DRILL CHAMFER
- DRILL COUNTERBORE
- DRILL REAMER
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Delivery in Ten Days

WRITE FOR COMPLETE CATALOG



910 E. MAIN ST., MONTPELIER, OHIO

world's largest producer of Sublands

## This Month's **GEAR PIX**

### UP YOUR GEAR OUTPUT RATE WITH THESE NEW HIGH-SPEED HOBBERS

You can't beat these new horizontal single-spindle gear hobbers for versatility, speed, productivity and capacity. Michigan's latest — Model 1458-B — has a cutting cycle measured in seconds. It is completely automatic. Designed for either conventional or climb hobbing. Center distance — hob arbor to work spindle — is 8 inches. Hobs up to 4-pitch spur or helical gears. Maximum crossfeed stroke of hob is 5 inches. Write for descriptive literature.

### NEW GUIDE GIVES CLOSE LEAD CONTROL

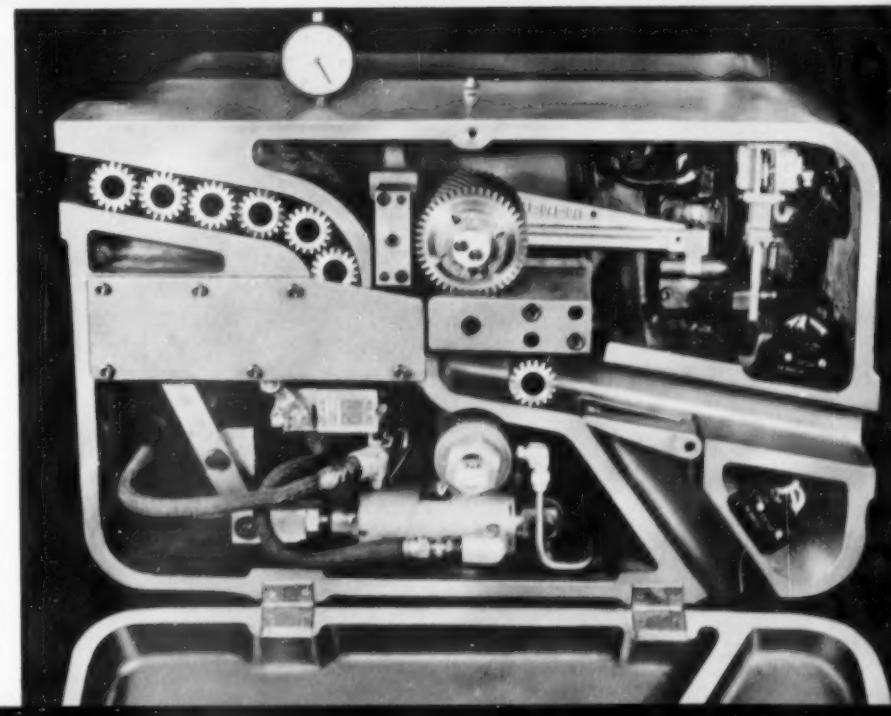
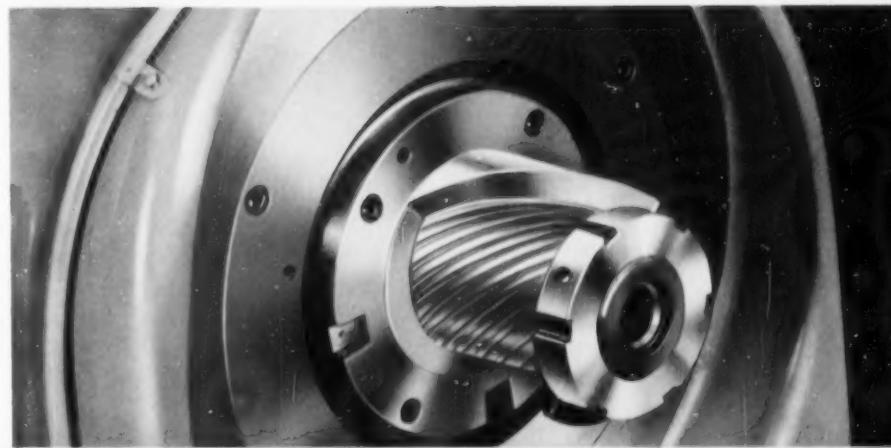
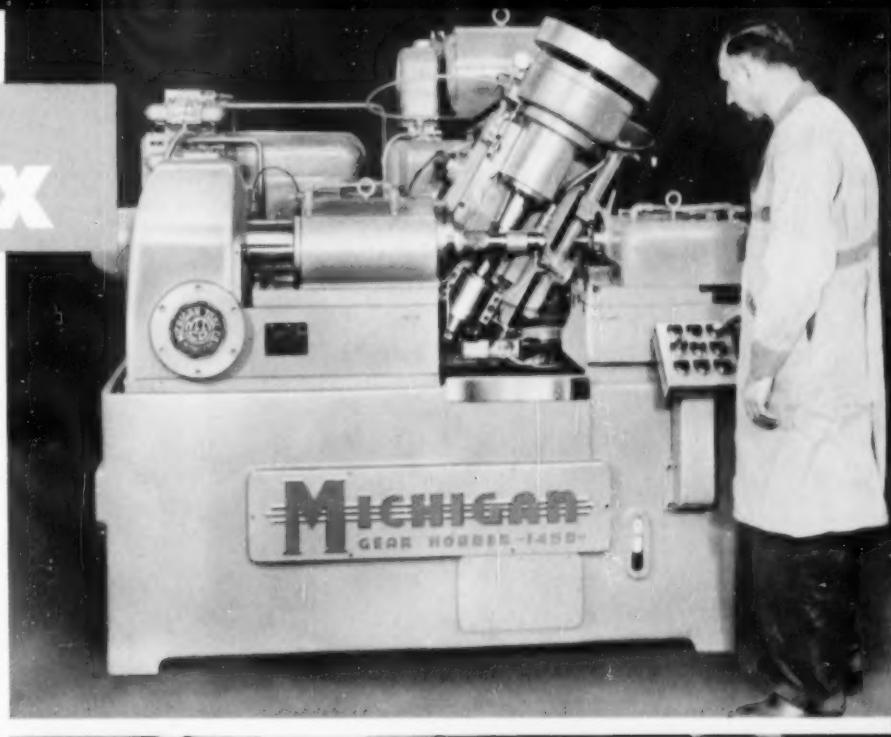
An inboard-mounted guide assembly on the 1458-B controls the helix angle being cut (R or L up to 35°) by introducing lead to the work spindle, thus eliminating change gears for controlling lead. Other features: standard conventional approach; optional "plunge-feed" approach, available where suitable for shortest time cycles. Of exceptional rigidity, Michigan's new hobber is of "unitized" construction — all assemblies being mounted on a common surface.

### A MICHIGAN EXCLUSIVE— AN AUTOMATIC GEAR CONCENTRICITY CHECKER

Now available—a unit that 100% inspects spur or helical gears for concentricity in a checking time of only 6 seconds! The checker automatically monitors and classifies. Tolerances are completely variable. Parts are rotated against a master gear in two directions, checked, and passed—rejects are shunted from process. Engineered in sizes to suit large or small gears. Send for details on Michigan's complete line of gear analysis equipment.

### **MICHIGAN TOOL COMPANY**

7171 E. McNICHOLS RD. • DETROIT 12, MICH.  
IN CANADA: COLONIAL TOOL CO., LTD.



*This Month's*  
**GEAR PIX**

GEAR-O-MATION'S  
"Velvet-Drop" Parts Lowerator

**SIMPLIFY YOUR  
AUTOMATION WITH  
GEAR-O-MATION UNITS**

Now you can put top efficiency into any automatic setup. Whether it is a single machine or a complete line, Gear-O-Mation has functional units to fit. They not only handle and transfer all types of parts but also serve as control equipment for directional movement, mobile storage and demand feeding. Units such as those shown here are controlling production cost patterns in many industries. We believe Gear-O-Mation can help you, too. Write for full details.

**BASKET LOAD  
YOUR PARTS FASTER**

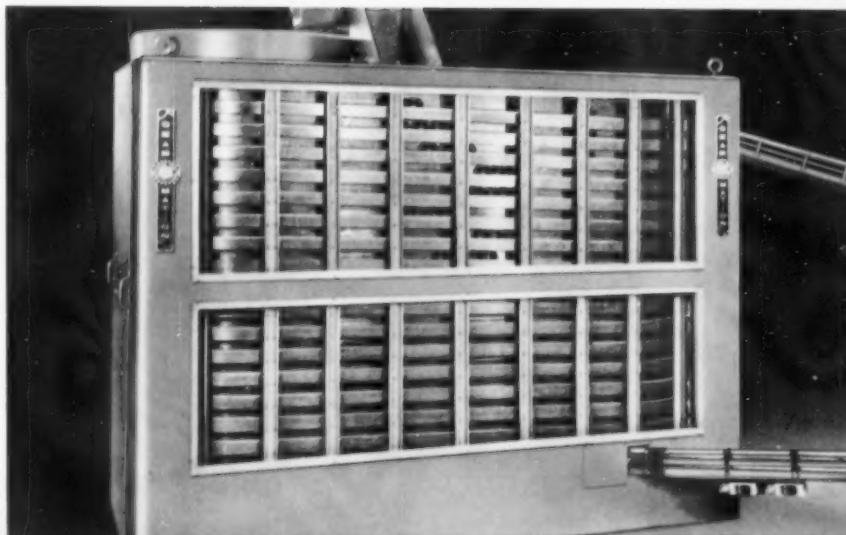
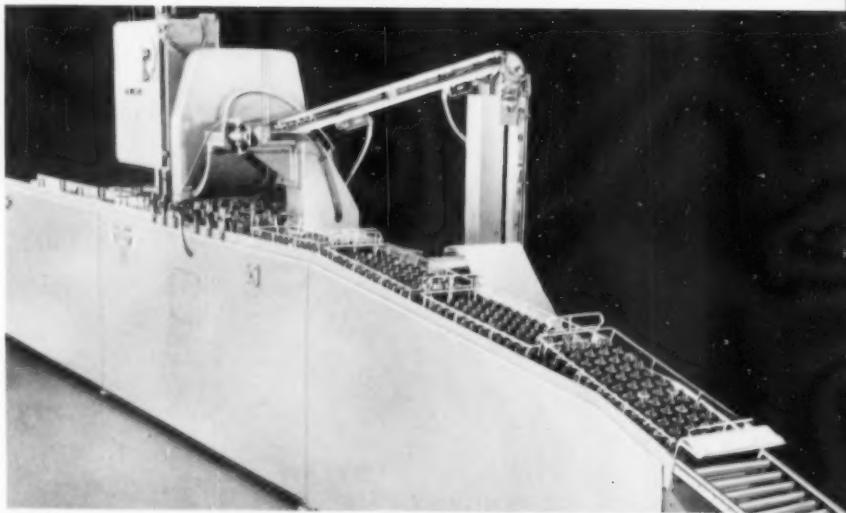
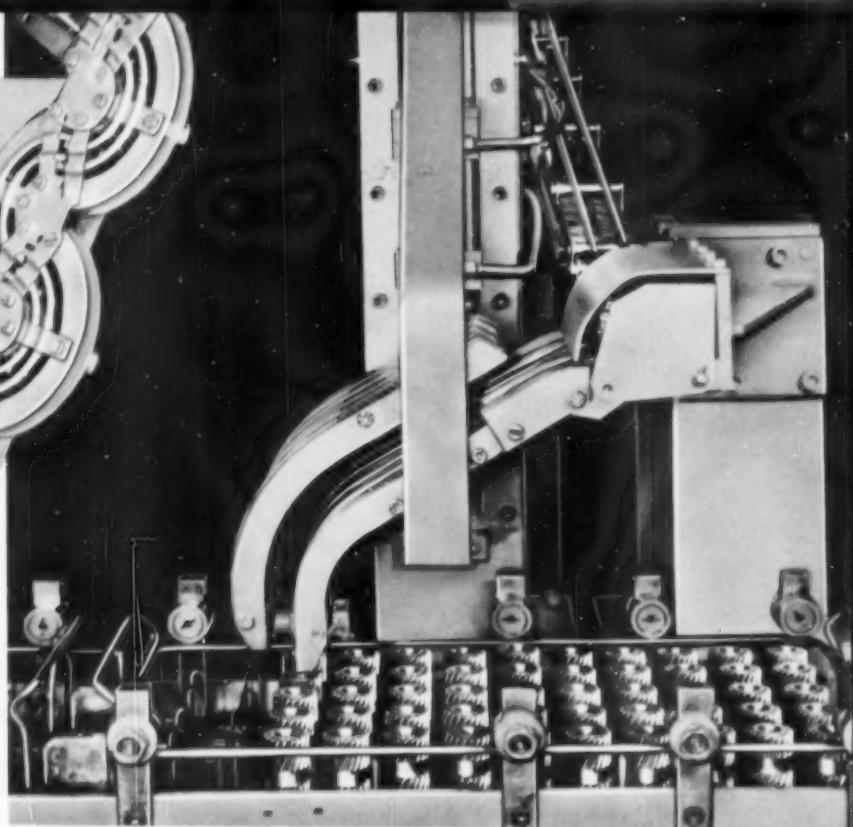
Basket loading need not be a processing bottleneck. Gear-O-Mation's basket loader does it automatically. Assembled from standard components to suit your parts. Middle photo shows loading of center-bored pinions at 3000 per hour. In upper right photo you can see how parts drop onto upright basket prongs a full row at a time. Send for bulletin GO-568.

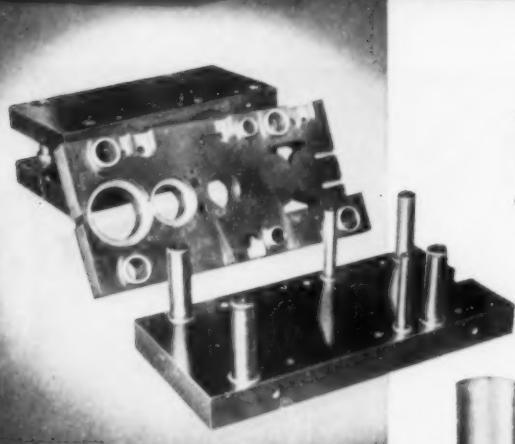
**HIGH-CAPACITY  
PARTS BANK  
STORES AND FEEDS**

A new Gear-O-Mation storage unit (at right) is for parts that can roll. Parts are gently propelled up a slightly inclined, continuous track as they lean against a slowly revolving, continuous belt. Unit provides true demand feed from active storage. Typical capacity is 2500 blanks 2 inches OD. In continuous operation you can feed 5000 parts an hour. Write for additional information.

**GEAR-O-MATION**

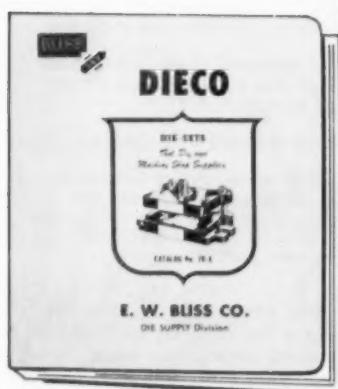
DIVISION OF MICHIGAN TOOL COMPANY  
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# Big or Small

*we make them all...*



**JUST OFF THE PRESS...** and yours for the asking: a simple easy-to-use catalog of all standard and special die sets and die maker's supplies.

There are no limits on size...thanks to its facilities, Dieco can make special die sets for any press built.

And to speed these die sets to you, we have now made it possible for your local Dieco branch or dealer to give you an on-the-spot quotation on any special die set. Without having to refer back to the main plant, he can save you days on delivery.

Dieco service is not only fast, it's complete. Our branches stock all standard die sets and a broad line of die maker's supplies. For more information call your Dieco dealer or branch or write us directly.

**dieco**®

DIE SETS

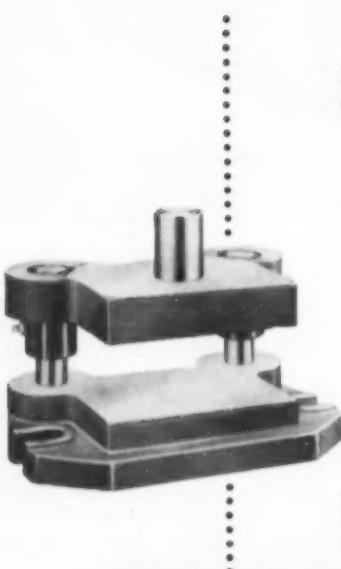
**E. W. BLISS CO.**  
DIE SUPPLY DIVISION  
Cleveland • Ohio

Because  
details  
COUNT  
in  
metal  
stamping  
production



*They're precision built  
in every detail for highest  
production accuracy!*

**DANNEMAN**  
PRECISION  
**DIE SETS**



Notice the details and *see* the difference in die sets! Then you'll know why there are so many loyal Danneman die set customers. Here's what they like about them . . .

- Extra clamping area and increased strength provided by all-around flanging.
- Increased accuracy and **absolute** interchangeability between die shoes and punch holders by precision boring on master plates with Moore special boring machines and De Vlieg boring bars.
- Complete squareness of leader pins and bushings assured by assembly on cylinder square fixtures.
- Parallelism of die shoes and punch holders insured by precision Thompson-grinding on four horizontal surfaces (even the U-lugs are machined for extra clamping accuracy).
- Shank located on center line of die area.
- Leader pins spaced to allow blanks to fall through when press is inclined and still retain maximum stability.
- Even inch increment of die spaces.
- Choice of Lamina precision hardened and ground bushings and leader pins with lubricating devices — or lower cost regular plain hardened and ground steel bushings with grooved guide posts.

Customers know factors like these are responsible for the better quality control, shorter down time, lower cost and higher production obtainable with **DANNEMAN DIE SETS**. Try them on *your* next high-production job and see the difference *precision in detail* can make! Catalog on request.

**DANNEMAN**  
DIE SET DIVISION

**ACME-DANNEMAN CO., INC.**

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Algonquin 5-7150 *Works:* 203 Lafayette St., New York 11, N. Y.

DO YOU  
NEED BETTER WAYS  
TO STRIP PAINT?

CAN YOU USE  
A STRIPPER FOR EPONS?

When tough finishes  
resist your present stripping methods,  
you may need our help.

If your problem is in this column

See note below

How to remove epon lacquers, paints and enamels.

A

How to strip paint, pigment residues, phosphate coatings, rust and oil in one operation.

B

How to strip paint from rejects, conveyor chains, racks and hooks in continuous operation.

B

How to strip oil-base paints . . . synthetic enamels . . . alkali-resistant plastics . . . resin-base paints . . . japans . . . wrinkle finishes . . . nitrocellulose lacquers . . . alkyds . . . phenolics . . . ureas

C

How to strip zinc chromate primers without etching aluminum.

C

How to strip paint from vertical surfaces and undersurfaces where thin-bodied strippers run off without stripping

C

How to strip metal parts that are too large to be soaked in tanks.

C



**FREE** For full information  
on your problems, ask for:

A—Bulletin B-6530 "Oakite Stripper S-A".

B—Booklet "Here's the best shortcut in the field of organic finishing"

C—Booklet "How to STRIP PAINT".

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Export Division Cable Address: Oakite

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**Square Cuts or angle cuts to 45° on ANY metal at 2 to 4 seconds per square in. with the**

## **STONE**

**MODEL M-75**

### **CHOP-STROKE CUT-OFF MACHINE**

**M-75** Optionally equipped for fully automatic production with Automatic Bar Feed; Power Stroke; and Oil Mist Spray attachment. Single or special manual cuts may be made when necessary.

#### **AVAILABLE FOR MANUAL, SEMI-AUTOMATIC OR FULLY AUTOMATIC OPERATION**

One of the most versatile cut-off machines on the market today. Permits set-ups or resets in a matter of seconds. Runs many different shapes, lengths and diameters of bar stock — from extruded aluminum to hardened tool steel — all in a single day. Will hold any of these to mill-like tolerances of .005" for days on end. Handles solid stock up to 2½" in diameter, or 4" pipe and structurals . . . giving up to five times greater production on each one! In spite of greater speed of cutting, there is no change of characteristics or hardening of material cut on this machine. Geared-in-head motor drive, a Stone exclusive, delivers maximum power to cutting edge for greatest efficiency.

#### **OPTIONAL FEATURES**

**Automatic Bar Feed** for continuous unbroken feeding of stock of any shape or diameter.

**Semi-Automatic Power Stroke** provides simpler operation, minimizes operator fatigue, gives up to 25% longer wheel life.

**Oil Mist Spray Attachment** for cooler, easier cutting — increases saw blade life up to 400% on non-ferrous materials.

**MACHINERY BY STONE** includes a complete line with many optional features. Write for complete information, no cost or obligation. Sales and service in principal cities.

*"...represented in every major industry throughout the world"*

## **STONE MACHINERY COMPANY, INC.**

31 Fayette Street, Manlius, New York

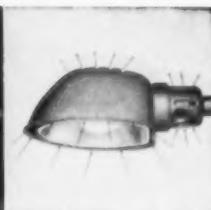
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## **DAZOR FLOATING LAMPS**

**Fit the Lighting to Each User and Each Job**



Top-Mounted Reflector



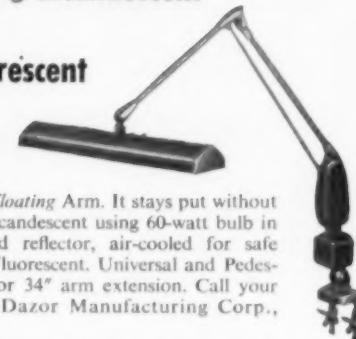
Side-Mounted

### **Air-Cooled Incandescent**

**or**

### **Fluorescent**

People . . . jobs . . . lighting needs differ. Let each employee control light location with the Dazor Floating Arm. It stays put without locking. Choice of Incandescent using 60-watt bulb in top- or side-mounted reflector, air-cooled for safe handling; or 2-tube Fluorescent. Universal and Pedestal models with 24" or 34" arm extension. Call your Dazor distributor. Dazor Manufacturing Corp., St. Louis 10, Mo.



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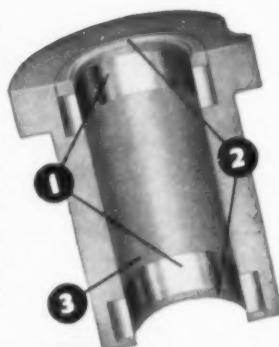
## **MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES**

### **IN Automation!**

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



**PATENTED**

1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

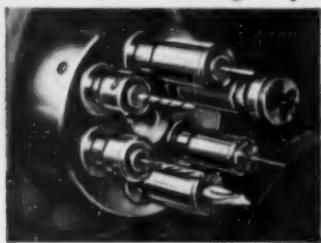
EST.  
1888



**W. F. MEYERS CO., INC., BEDFORD, INDIANA**

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Detail of drum turret showing six spindles

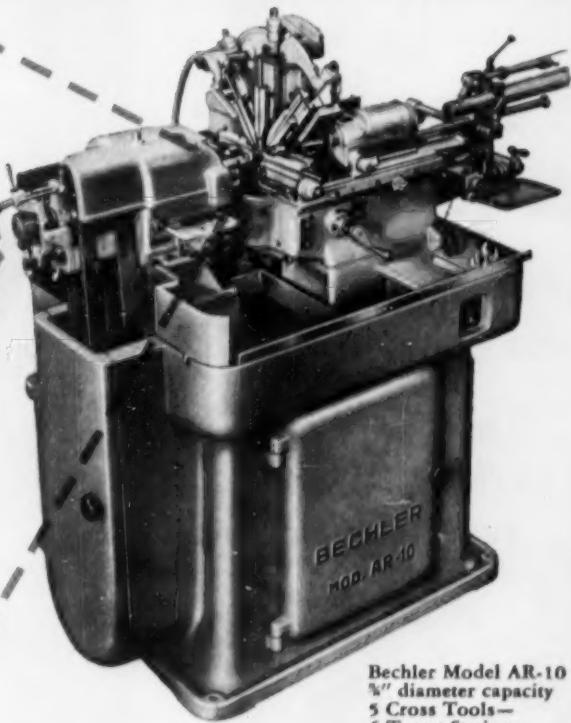


# TURRET LATHE VERSATILITY added to SWISS AUTOMATIC PRECISION

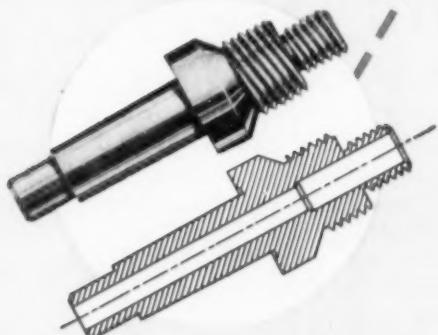
ONE MACHINE COMBINES  
6-SPINDLE AXIAL DRUM TURRET  
WITH 5 CROSS TOOLS

**BECHLER**  
SWISS AUTOMATICS

This remarkable combination has resulted in a Swiss Automatic of tremendous versatility. Addition of a six-station drum turret permits a wide variety of set-ups with simple, standard tools. The 11 separate tool stations permit production of completely finished, precision parts. Secondary operations are eliminated—output is increased—yet the precise performance of standard Swiss Automatics is retained. These machines are available in three sizes with capacities up to 1½ inches.



Bechler Model AR-10  
¾" diameter capacity  
5 Cross Tools—  
6 Turret Stations



Steel precision part produced on AR-10. Diameter—.250", length—.750", 1 single and 1 double lead thread, recess and taper behind shoulder, bores concentric with outside diameters.

## TURRET FEATURES

- Six adjustable spindles—rotating or stationary—for centering, drilling, reaming, threading and tapping. Up to 4 of these spindles can be tooled for internal or external threads—right, left or mixed.
- Rapid, hydraulic spindle indexing—operated by standard, adjustable trip dogs instead of indexing cams.
- Accurate tool alignment—turret is securely locked on an extra large disc.
- Idle spindle travel reduced—horizontal turret positioned to suit length of workpiece.

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—nationwide sales and service of precision machine tools—  
—from bench lathes to boring mills.

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

IN CANADA CONTACT COSA CORPORATION OF CANADA, LTD., 1160 Lakeshore Road, Long Branch, Toronto 14, Ontario

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BUT WOULDN'T YOU  
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TECHNICAL ADVANCE?



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*another significant  
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**"Job Tempered"**

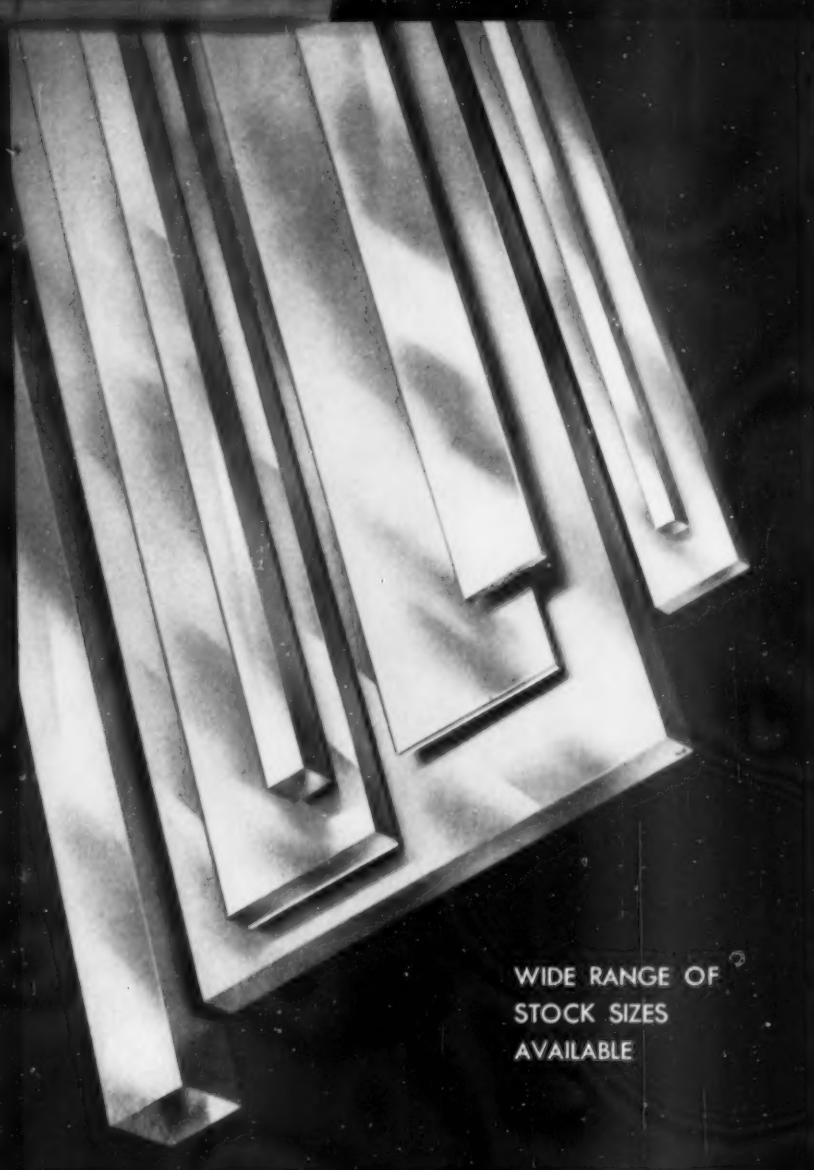
**Flat Ground**

**Die Steel**

Heller's new JOB TEMPERED Flat Ground Die Steel is a truly significant advance in the field.

For one thing, its analysis is recommended by a group of leading consulting metallurgists. For another, it is precision-ground to a smooth surface finish of 25 to 35 micro-inches with all surface defects and decarburization removed to save time and effort in tool making.

It's easy to heat-treat, too. For instance, Heller Oil-Hardening Die Steel will achieve a Rockwell C hardness of 64-65 when hardened within a temperature range of 1450°F. to 1540°F. And a similarly wide range applies to the Air-Hardening type. Simple tempering instructions are supplied with each piece, so the entire heat-treating process is non-critical and virtually foolproof. As a result, you are sure of getting all the benefits of JOB TEMPERED tools, dies, jigs and fixtures when they're made from this superior Heller Die Steel.



Check  
the Die Steel  
or  
Tool Steel  
you may be  
using now.

Then let us show you why Heller JOB TEMPERED Die Steel is more efficient and economical to use . . . and will turn out tools that will do the job better and last longer.

Here are the Facts!

Heller's new folio of JOB TEMPERED Flat Ground Die Steel will give you full information on sizes and types available, heat treating, applications, physical properties, etc.

Write today for your copy.



... the analysis recommended by leading consulting  
metallurgists for Job Tempered Tools and Dies



HELLER TOOL CO., America's Oldest File Manufacturer  
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SOLD EXCLUSIVELY THROUGH



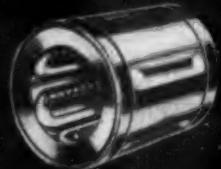
NOW! Adjustable Diameter and Open  
**THOMSON** **BALL BUSHINGS**



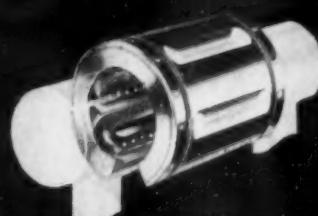
Adjustable Diameter BALL BUSHING for Zero Clearance

LOW FRICTION • ZERO SHAKE OR PLAY  
ELIMINATE BINDING AND CHATTER  
SOLVE SLIDING LUBRICATION PROBLEMS  
LONG LIFE • LASTING ALIGNMENT

Also manufacturers of NYLINED  
Bearings . . . Sleeve Bearings of  
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Precision Series "A" and  
Low Cost Series "B" BALL BUSHING



Open BALL BUSHING  
for Zero Clearance on  
Supported Shafts

The BALL Bearing for all your  
**LINEAR  
MOTIONS**

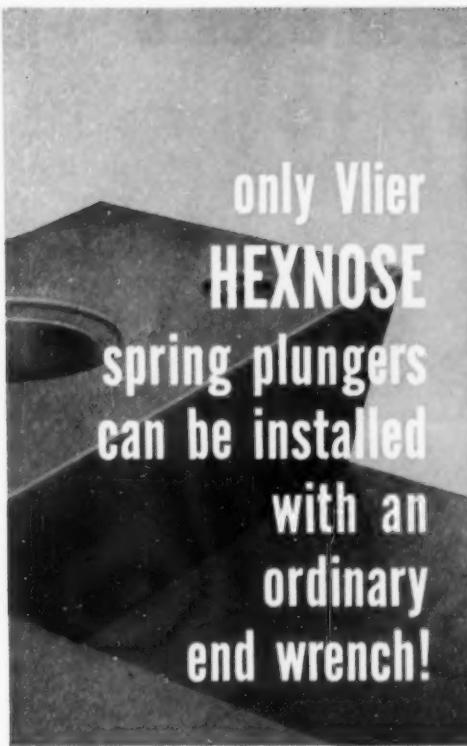
Sliding linear motions are nearly always troublesome. Thousands of progressive engineers and designers have solved this problem by application of BALL BUSHINGS on guide rods, reciprocating shafts, push-pull actions, or for support of any mechanism that is moved or shifted in a straight line.

Improve your product! Up-date your design and performance with Thomson BALL BUSHINGS!

The various types cover a shaft diameter range of  $\frac{1}{4}$ " to 4". Small sizes available in Stainless Steel. Write for literature and name of our representative in your city.

**THOMSON INDUSTRIES, Inc.**  
Dept. A, MANHASSET, NEW YORK

PROGRESSIVE MANUFACTURERS USE BALL BUSHINGS-A MAJOR IMPROVEMENT AT A MINOR COST



only Vlier  
**HEXNOSE**  
spring plungers  
can be installed  
with an  
ordinary  
end wrench!

Hexagonal nose  
eliminates need  
for spanner-type  
wrenches; speeds  
insertion, adjustment  
and removal!

PATENT NO. 2,781,914



THERE'S A Vlier  
SPRING PLUNGER  
FOR ALMOST EVERY  
CONTROLLED-END-  
PRESSURE APPLICATION!



Standard

Primarily used in ordinary jigs  
and fixtures.



Silvernose

Light end pressure for repetitive  
die applications.



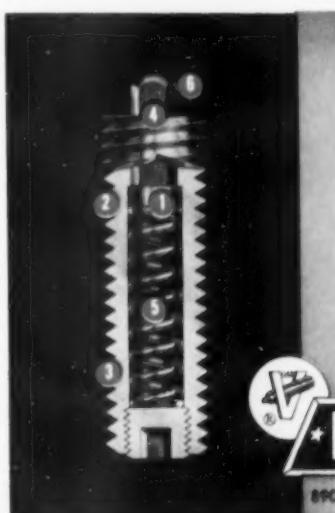
Plastic Nose

For use with aluminum, brass  
and other soft materials.



Hexnose

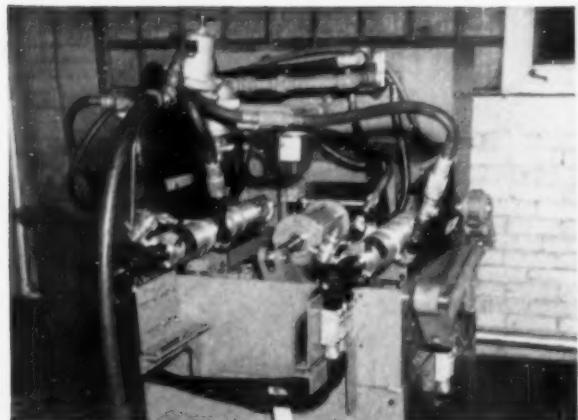
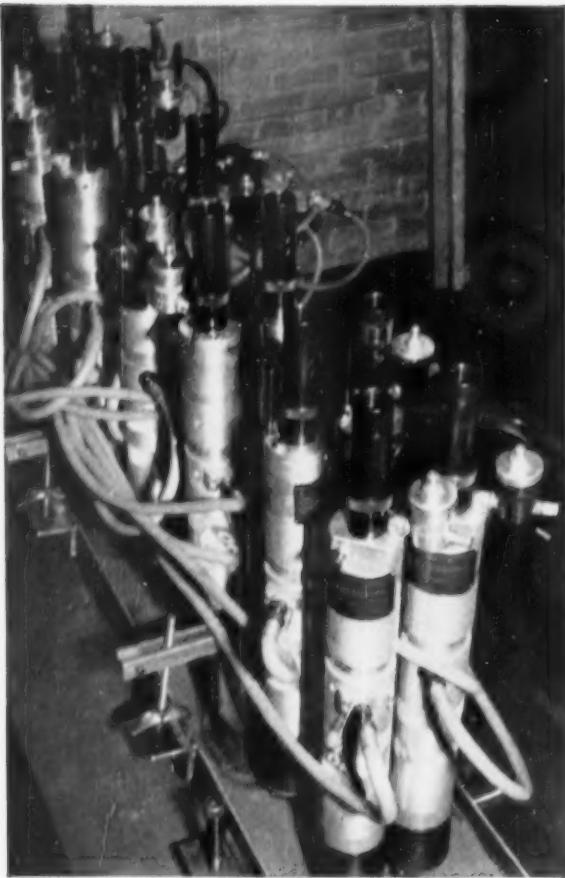
For greater ease in installing,  
adjusting and removing.



Send for  
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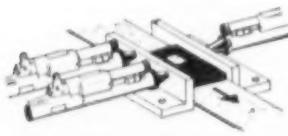
8900 Santa Monica Blvd., Los Angeles 46, California



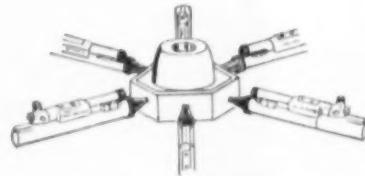
**for accurate holes in a hurry**  
**... USE KELLER TOOL "AIRFEEDRILLS"®**

"AIRFEEDRILLS" are easily adapted to almost any drilling setup. You mount them as a drilling unit of from two to 20 spindles for automatic hole processing. Use one as a stationary drill mounted on an inexpensive fixture. As a portable drill, "AIRFEEDRILL" hangs by its nose to a jig for precision drilling.

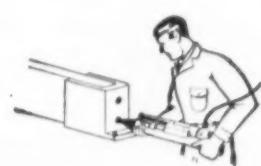
If you are drilling, reaming, countersinking, chamfering, counterboring or spot facing, ask your Gardner-Denver representative to show you how a Keller Tool "AIRFEEDRILL" setup can help you save time and cut costs. Or send for bulletins on Keller Tool "AIRFEEDRILL" units and drill bushing tips.



Automatic drilling unit



Stationary drilling



Portable unit



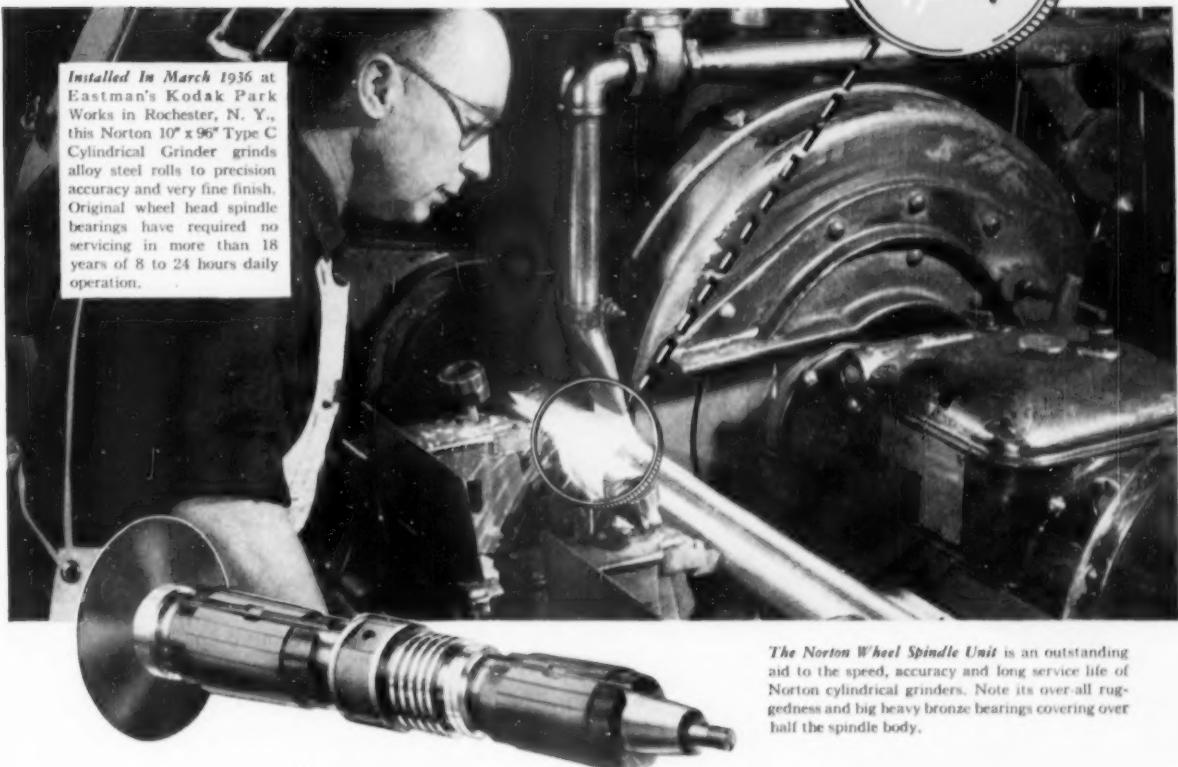
ENGINEERING FORESIGHT—PROVED ON THE JOB  
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

**GARDNER - DENVER**

Gardner-Denver Company, Quincy, Illinois

# How Eastman Kodak gets Extreme accuracy...fine finish... years of trouble-free grinding

*Norton wheel spindle a key factor in  
grinding performance that means...*



*Installed in March 1936 at  
Eastman's Kodak Park  
Works in Rochester, N. Y.,  
this Norton 10" x 96" Type C  
Cylindrical Grinder grinds  
alloy steel rolls to precision  
accuracy and very fine finish.  
Original wheel head spindle  
bearings have required no  
servicing in more than 18  
years of 8 to 24 hours daily  
operation.*

*The Norton Wheel Spindle Unit is an outstanding  
aid to the speed, accuracy and long service life of  
Norton cylindrical grinders. Note its over-all rug-  
gedness and big heavy bronze bearings covering over  
half the spindle body.*

*Why are Norton cylindrical grinders so fast  
and accurate over such a wide range of preci-  
sion finishing and heavy stock removal jobs?*

*Why do these hard-working machines last  
so long, cost so little to maintain?*

Advanced features like the Norton wheel spindle unit are the answer. Advantages of this typical Norton development for better, lower cost grinding include:

- Over 50% of spindle body enclosed in two large heavy-duty, hard bronze bearings for extra long life.

- Rugged proportions, and metals toughened by special heat treating, are further aids to long service.

- Rigid support over practically the entire spindle surface affords maximum resistance to wheel pressures.

- Bearing length of more than twice the diameter increases bearing life.

- Automatic flood lubrication of bearings, with flow continually visible through bull's-eyes — an important safety and control feature.

- End thrust taken on two large, hardened steel surfaces, also flood lubricated.

- Modern precision boring for exact oil clearance keeps lubrication at top efficiency.

- Wheel speed changes possible without readjusting bearings.

- Extremely low unit pressure, due to long, continuous bearing surfaces, permits fast cutting and enduring accuracy.

For further facts on how Norton cylindrical grinders can benefit your production, see your Norton Representative. Or write

direct for Catalogs. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost. **NORTON COMPANY, Machine Division, Worcester 6, Mass. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.**

**To Economize, Modernize with NEW**

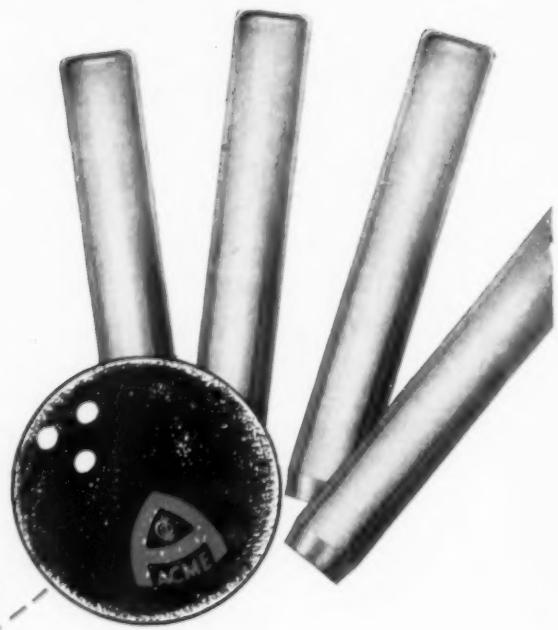
**NORTON**  
**GRINDERS and LAPERS**

*Making better products...  
to make your products better*

District Sales Offices: Worcester • Hartford • New York  
(Teterboro, N. J.) • Cleveland • Chicago • Detroit

# faster delivery

FROM YOUR LOCAL  
INDUSTRIAL DISTRIBUTOR'S STOCK



## ACME Dowel Pins



- Standard PINS available in lengths from  $\frac{3}{8}$ " to 6"— $\frac{1}{8}$ " to 1" in diameter. Specials, including pins of stainless steel, quoted on request
- Precision pins, hardened and ground to .0002" or .001" over nominal diameter—also available: .002", .003", .004" and .005" oversize—all diameters .0001"
- Acme Pins are case hardened to 60-62 Rockwell "C" scale and a core hardness of 36-38
- Acme Pins will break before bending or mushrooming

Write for information and prices on standard and oversize dowel pins

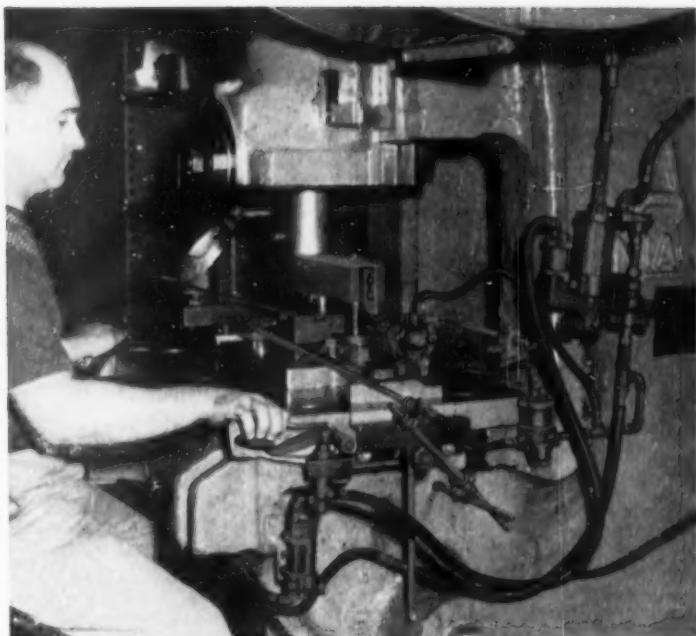
**ACME INDUSTRIAL COMPANY**

# For automation and safety... Schrader Packaged Air Sets upgrade machine tools

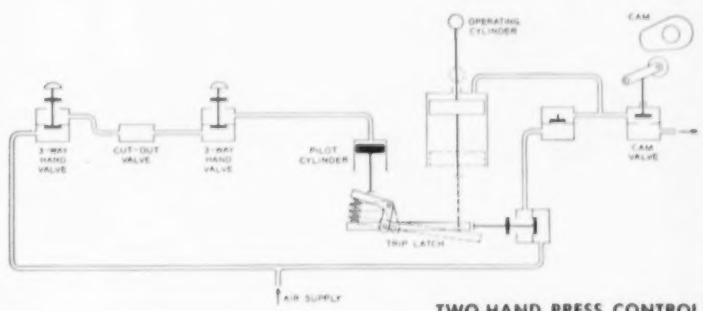
Schrader Packaged Air Sets eliminate hazards to press control and ejection systems operators like the man at right. They force him to keep his fingers free because the hands that feed the press or tool must also operate it. And both hands *must be used at once*—can't stray into danger. Fast, clean air ejection—moves the part off—automatically!

At the same time, performing both stamping and ejecting, finger and toe-tip action is light as air—keeps this operator fresh and efficient—steps up production! You can have the same!

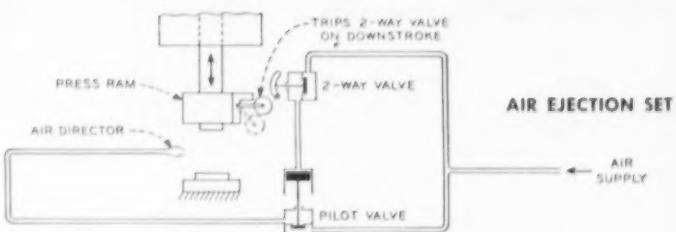
Use these versatile pneumatic machine controls and air ejection sets not only on power presses, but shears, brakes, friction clutches, and any machine using a mechanical clutch. They are "off-the-shelf" items—ready to use! Write Schrader for details. Our distributors are located close by. Your most special requirements will in all likelihood be no problem at all with convenient, low-maintenance Schrader packaged control sets.



Punch press will not operate unless both hand valves are pressed at once. The press cycle cannot be repeated until the hand valves are released and the pilot cylinder is vented to atmosphere by the cam valve. A cutout valve prevents continuous press operation with one hand valve tied down. Air ejection is accomplished by cam action that actuates air column. Safety first with a Schrader Packaged Air Set.



TWO-HAND PRESS CONTROL



AIR EJECTION SET

**A. SCHRADER'S SON • Division of Scovill Mfg. Co., Inc.**  
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

Please send latest informative booklets which show Schrader's complete line of products.

Name

Title

Company

Address

## A. SCHRADER'S SON

Division of Scovill Manufacturing Company, Incorporated  
462 Vanderbilt Avenue, Brooklyn 38, N. Y.

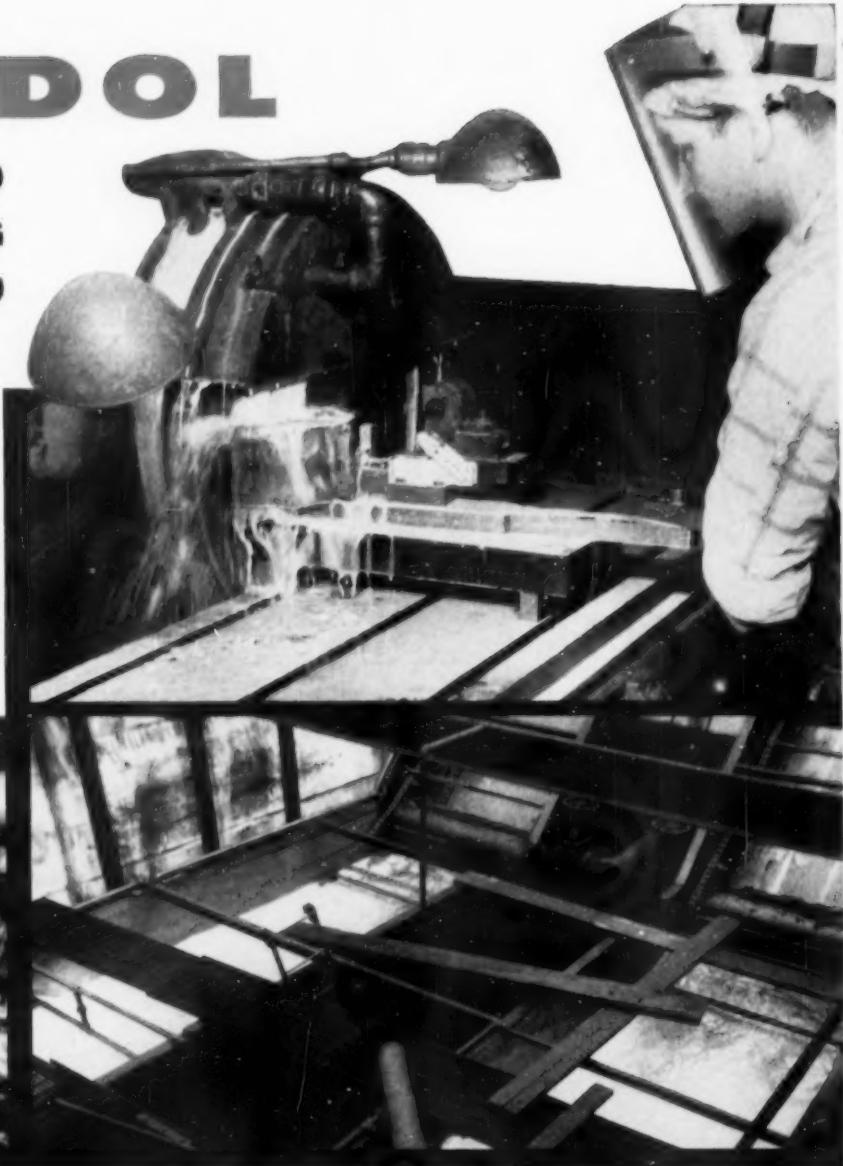
QUALITY AIR CONTROL PRODUCTS



# Stuart CODOL

## LIQUID GRINDING COMPOUND

Disc grinder (right) hogs off approximately .035 in. from rough Alnico castings. Small segmented bar-type magnets are ground at a high rate of production on an automatic double-spindle disc grinder. Stuart's Codol helps maintain profitable production . . . covers machine ways and moving parts with a rust-inhibiting film of light petroleum oil.



Continuous grinding is more efficient with Codol as it resists overheating, minimizes wheel loading . . . reduces downtime for sharpening the wheel.

Codol's stability prolongs its effectiveness, reducing cutting oil costs. More than 15,000 gallons of a 3.5 per cent Codol and water solution are circulated from this outdoor reservoir to a battery of grinders in the Spaulding Works of Crucible Steel Company.

### How you can use Stuart's CODOL to step up production and reduce costs!

Take advantage of today's improved wheel bonds and more powerful grinding machines by using Stuart's Codol Liquid Grinding Compound . . . a carefully formulated combination of petroleum oil and emulsifier. To give you maximum on-the-job economy, Codol permits faster stock removal, using heavier feeds and harder, larger wheels. For Codol *lubricates* as it cools, prevents metal flow and wheel loading, and eliminates stress failure from heat generated by grinding. On precision work, Codol guards against heat distortion and assures maximum dimensional control . . . especially important when grinding thin-walled parts. Break the heat barrier and upgrade performance on your cylindrical, centerless, and surface grinding operations with Stuart's Codol!

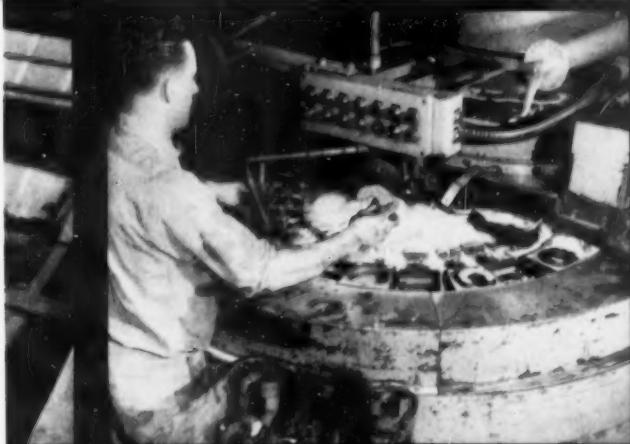
"Rust problems eliminated with Stuart Codol," that's the report from the Spaulding Works of Crucible Steel Company, Harrison, N. J.—makers of widely used Alnico magnets. Experience there on several different grinding machines has proved that Codol's high detergency, lubricity, cooling, and rust-inhibiting characteristics save money by reducing machine wear . . . prolonging wheel life . . . providing good stock removal conditions for rough- and finish-grinding operations.

Since these grinders are serviced from a central reservoir, a highly developed water-mix compound is important for over-all production efficiency at Crucible.

Codol's carefully balanced surface tension floats chips away from the wheel, work, and machine . . . provides a protective film of lubricating oil for machine ways, guide bars, and moving parts . . . gives two-way cooling action that assures efficient grinding at high production rates.

## Crucible Steel Co. eliminates rust, reduces machine wear, grinding with Stuart's Codol!

Codol keeps wheel free-cutting on this high-production, single-pass grinding operation, with .0025 in. downfeed per revolution.



Template checks accuracy of convex poles after grinding ends of rough Alnico castings. Codol keeps wheels sharp and free-cutting when "hogging off" stock on the disc grinder.



Phone your  
Stuart Service Center

Arrange now to test Stuart's Codol on your difficult grinding jobs.

**DETROIT, MICH.**

Tyler 7-8500

**CHICAGO, ILL.**

Bishop 7-7100

**HARTFORD, CONN.**

Jackson 7-1144

**CLEVELAND, OHIO**

Prospect 1-7411

**PHILADELPHIA, PA.**

Devonshire 8-6100

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SINCE 1865

**D. A. STUART OIL CO., LIMITED**

2727 South Troy Street, Chicago 23, Illinois

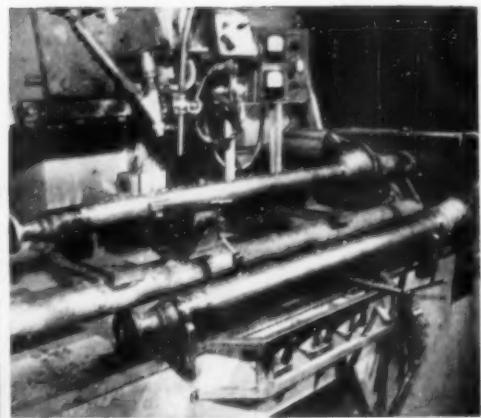
**CANADIAN D. A. STUART OIL CO., LIMITED**

3575 Danforth Avenue, Toronto 13, Ontario

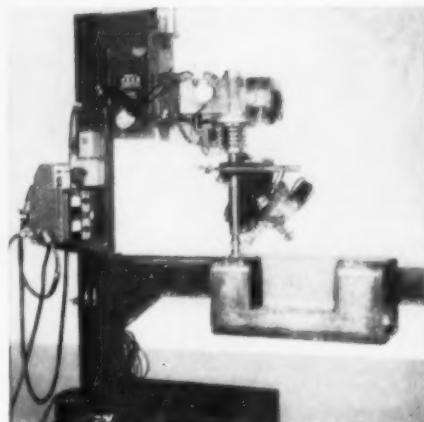


**METALWORKING  
LUBRICANTS**

Rear axle and differential housings assembled and welded with Lincolnweld automatic submerged arc welding.

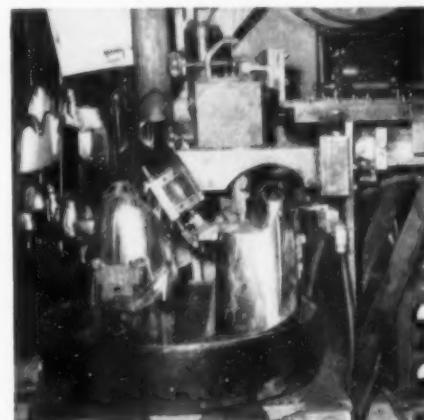


Torque tube assembled by automatic welding. Accurate control saves wire and flux.



Automatically welded fuel tanks have stronger seams to resist leaking or bursting under impact.

Quality welds without pits or flaws required on bright parts which must be ground smooth and plated are made at low cost with Lincolnweld.



## Sure starts..Precise control

assure continuous, low-cost automatic production

### Lincolnweld puts Automation in Arc Welding

Low-cost automatic production calls for absolute dependability of operation . . . with minimum supervision. For efficient, automatic welding, Lincolnweld assures this dependability with sure arc starting on every cycle . . . plus . . . precise arc control for top quality welds at top welding speeds.

Bulletin SB-1355 tells how automatic Lincolnweld can be applied to many types of work. Write for it.



THE LINCOLN ELECTRIC COMPANY

Dept. 5018, Cleveland 17, Ohio

The World's Largest Manufacturer of Arc Welding Equipment

**W**hen  
Lincolnweld  
welds faster

**H**as more  
accurate  
controls

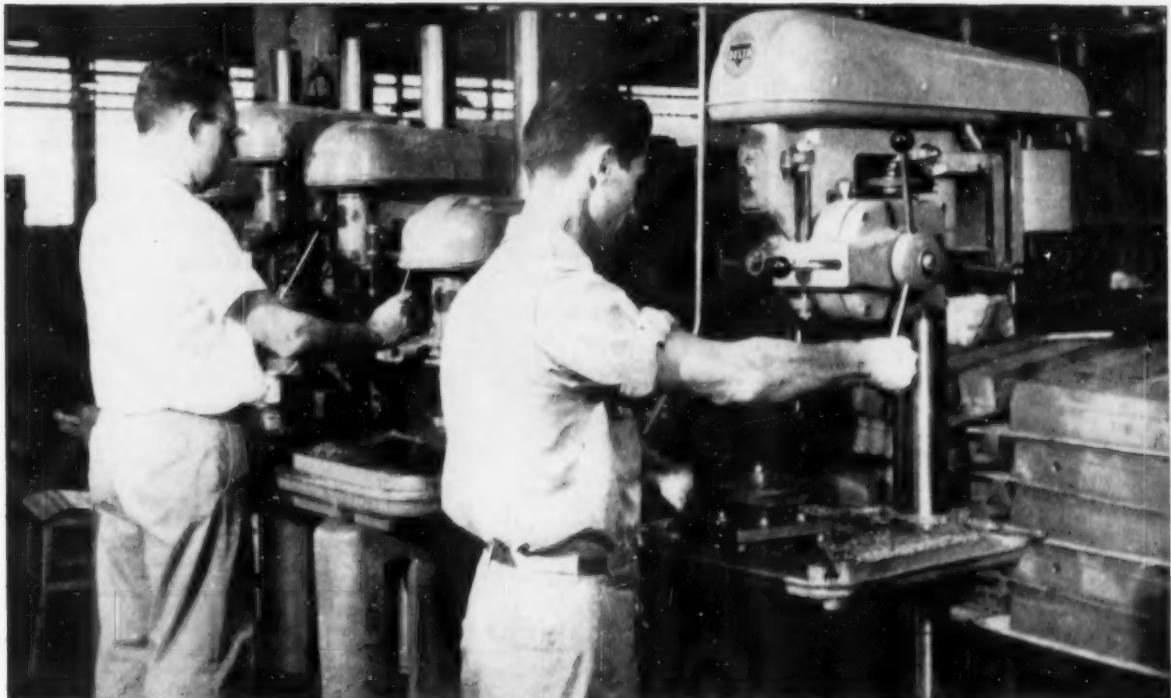
**Y**et costs  
less to  
operate

**WHY**

don't you tool-up with  
Lincolnweld automatic welders?

ROCKWELL-BUILT

# new **DELTA** 20" drill press



## ...fills need for low cost production tooling

Delta's great new 20" Drill Press was designed, engineered and built to fill industry's growing need for *flexible production tooling*. Here is why it can save you money by handling jobs normally requiring machines *costing four and five times as much*:

**BIG MACHINE CAPACITY**—You get full 6" spindle travel and long 5½" high column for *extra* spindle to table capacity, backed by massive construction and rugged power to match! It's a real production tool for jobs ordinarily demanding big, expensive special-purpose machines.

**POWER TOOL VERSATILITY**—New Delta 20" can be used singly for a wide range of production jobs, yet readily adapts to work in combination with special-

purpose machines. And you can move it *where you need it* to reduce materials handling, save costly man hours.

**LASTING PRECISION**—Delta's 30 years of unmatched quality power tool experience give you precision and performance features that assure exacting tolerances (and lower maintenance) through years of hard, continuous operation.

**SEE THE ENTIRE DELTA DRILL PRESS LINE**: Get all the facts about the new Delta 20" plus other new and improved Delta Drill Presses. Compare for quality, for precision, for value—and make up your *own* mind! Your Delta Dealer is listed under "TOOLS" in the Yellow Pages of your phone book.

**Send coupon for all the facts!**



another product by

**ROCKWELL**



**Delta Power Tool Division, Rockwell Manufacturing Co.**

**6201 N. Lexington Ave., Pittsburgh 8, Pa.**

Please send complete catalog on entire Delta Drill Press line.  
 Please send booklet: Delta Power Tools Teamed with Machine Tools.  
 Please send names of my nearest Delta Dealers.

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City \_\_\_\_\_ County \_\_\_\_\_ State \_\_\_\_\_

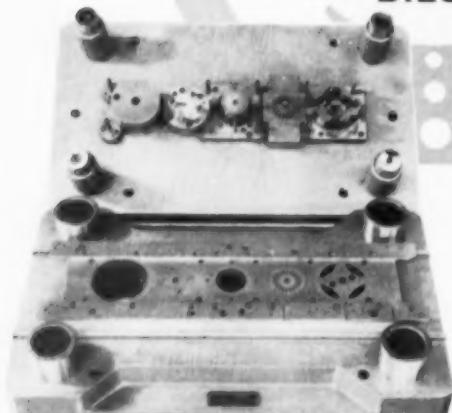
**FASCO**

SAVES  
**\$56,000**  
YEARLY...

WITH

Wm. P.

**Stein**  
CARBIDE  
LAMINATION  
DIES!



This precision CARBIDE die has produced, to date, over 17 million rotor and field laminations... an average of over one million of each per grind, with only .070" ground from the punches and .055" from the die. A conservative estimate of the total die life is well over 100,000,000 rotor and field punchings! FASCO indicates an estimated \$56,000 annual saving on *one* motor line, with the use of STEIN carbide lamination dies. These dies are famous the world over for their accuracy and durability and are a product of over 53 years of lamination experience.



FASCO INDUSTRIES INC., as a leading volume producer of fractional horsepower electrical motors, states: "The benefits of motor to motor uniformity, by the use of precision, burr-free laminations, have completely justified the conversion to CARBIDE dies, furnished by Stein, and have contributed substantially to the large volume acceptance of this motor in the trade." Shown above is the 4 pole, shaded pole motor of 1/50 to 1/25 horsepower, a basic item with FASCO for many years.

Our special engineering department will gladly quote on YOUR specifications. Cut your production costs with STEIN CARBIDE LAMINATION DIES!

Wm. P.

**Stein**

USE READER SERVICE CARD; INDICATE A-11-260-1

## The New SCHERR MICRO-PROJECTOR

with the  
**VERTICAL** design

**NEW  
1957**  
SELF CONTAINED  
IMPROVED MODEL  
FEATURING



BASIC PRICE  
**\$ 395.00**

- ✓ RIGID FLOOR BASE - ELIMINATING EXTRA CHARGE FOR TABLE
- ✓ TILTING STAGE FOR HELIX, ANGLES AND BEVELS
- ✓ 4" DIA. STAGE OPENING
- ✓ 14" DIAMETER SCREEN
- ✓ COLUMN SLIDE ADJUSTABLE FOR WEAR BY MEANS OF GIBS - WILL HOLD SQUARE INDEFINITELY.

- ✓ CUSTOM MADE PRECISION COATED LENSES & DOUBLE CONDENSERS FOR DIFFERENT OBJECTIVES 10 TO 100X MAGNIFICATION.

- ✓ AN ENTIRELY NEW PRACTICAL DESIGNED TOOL FOR INSPECTION DEPARTMENT AND PRODUCTION SHOP.

WRITE FOR ILLUSTRATED FOLDER

**GEO. SCHERR CO., Inc.**

COMPLETE LINE OF PRECISION INSTRUMENTS

200-TE LAFAYETTE STREET • NEW YORK 12, N.Y.

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## DRILLING COSTS TOO HIGH?

In Steel... Stainless... Brass...  
Aluminum... Titanium... and Wood

**HI-STANDARD Deep-Hole Drills**  
give you... at lower cost...

- Exacting Hole Diameters
- Unlimited Hole Depth
- Exceptional Hole Concentricity Throughout
- Improved Hole Surface Finish
- More Pieces Between Grinds



Write For Engineering File "D"

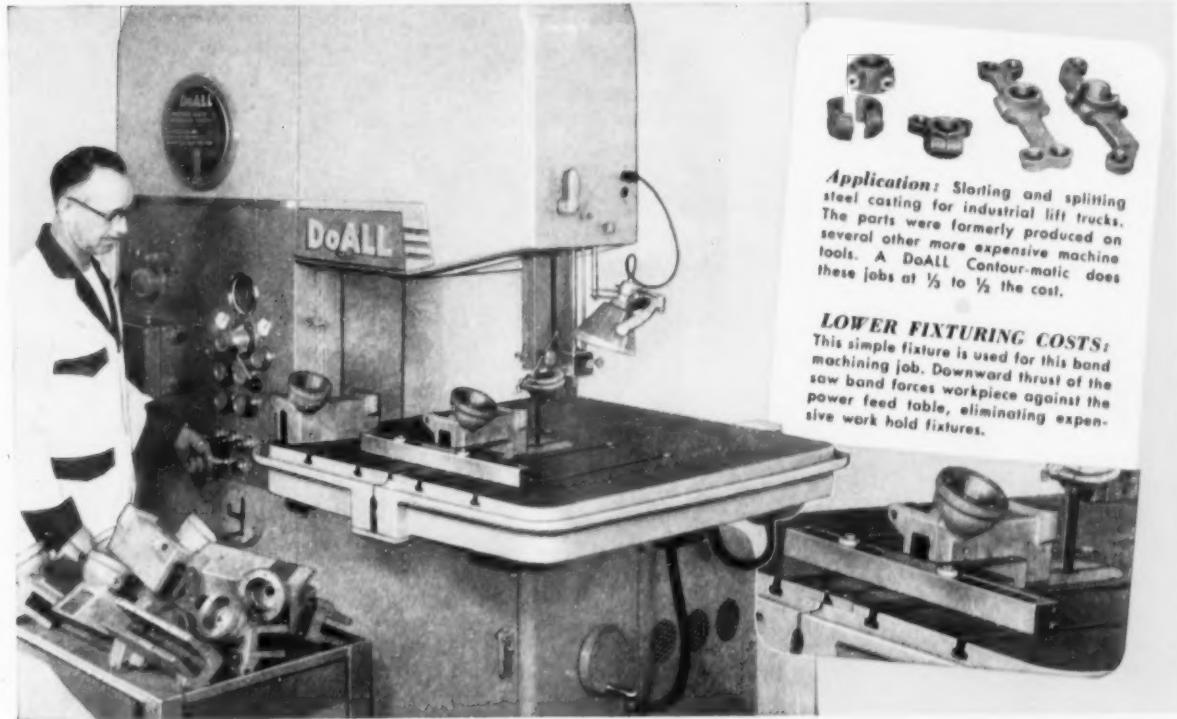
**THE HIGH STANDARD  
MANUFACTURING  
CORPORATION**  
Hamden, Connecticut

Pioneers and Makers  
of Deep-Hole Drills  
For More Than 30 Years

USE READER SERVICE CARD; INDICATE A-11-260-3

**The Tool Engineer**

# Cut Your Slotting and Splitting Costs with DoALL Band Machining



**Application:** Slotting and splitting steel casting for industrial lift trucks. The parts were formerly produced on several other more expensive machine tools. A DoALL Contour-matic does these jobs at  $\frac{1}{3}$  to  $\frac{1}{2}$  the cost.

**LOWER FIXTURING COSTS:** This simple fixture is used for this band machining job. Downward thrust of the saw band forces workpiece against the power feed table, eliminating expensive work hold fixtures.

**DoALL**  
high-speed steel  
**DEMON SAW BLADES**  
Due to its "red heat hardness" characteristics, this HSS saw (with over 1500 cutting teeth) "slices" through the toughest steel—even titanium—outlasting and outperforming any other saw band. Blades withstand cutting temperatures up to 1100° without losing tooth hardness . . . and last up to 30 times longer than carbon steel blades!

**New DoALL**  
**Contour-matic**  
Standard machine has hydraulic power feed table, infinitely variable blade speed, built-in coolant system, high horsepower, plus great rigidity for smoothness and accuracy.

Find  
Your DoALL Store  
In The  
'Yellow Pages'

B-42



## **DoALL Contour-matic—Industry's Newest High Production Machine Tool!**

The band machining application above is typical of DoALL speed, accuracy and low cost. There are HUNDREDS of other duplicate parts production jobs that can also be handled on the new DoALL Contour-matic—with the same results!

The DoALL Contour-matic has proven itself as the only really NEW machining concept developed in years for cutting slots or splitting parts on production line basis. What makes it possible? A new continuous-cutting high-speed steel saw band that accurately "slices" through any machinable metal in a fraction of the previous time . . . plus a powerful band machine with a hydraulic power feed table that automatically guides the workpiece into the blade. This new "integrated" combination of blade and band machine gives you faster, more economical slotting or splitting of all kinds of precision parts. And compare the lower machine investment with other machine tools. You'll realize why industry is switching to band machining for high-speed duplicate parts production!

Other production applications: Contour sawing, notching, slitting, friction sawing, line grinding or filing. Call DoALL locally today for a FREE "in-your-plant" DEMONSTRATION. Or, write for catalogs describing this new basic machine tool.

**DoALL** THE DoALL COMPANY  
Des Plaines, Illinois





A Bath tap is shown in a radial drill press, being used to thread holes in a Mack truck banjo axle housing, where the carrier bolts are fastened to the banjo.

—Unretouched photo  
courtesy of  
Mack Trucks, Inc.

## Another Bath Tap job well done for...

For many years the phrase "built like a Mack truck" has been commonly used to express strength and dependability.

This reputation for dependable transportation involves a policy of quality control in manufacture which starts with the selection by Mack of the finest working tools . . . such as "ground from the solid" Bath taps for threading axle housings.

Here is what this long-time user of Bath taps has to say:

*"The Mack Allentown factory has used this tap process (pictured) for more than 20 years with results that show excellent uniformity."*



If you have a threading problem—let us know the kind of material, the type of tapping machine used, the kind of fixtures and lubrication involved. With this information, our engineers will be glad to help you . . . may be able to bring about increased production and more uniform results.

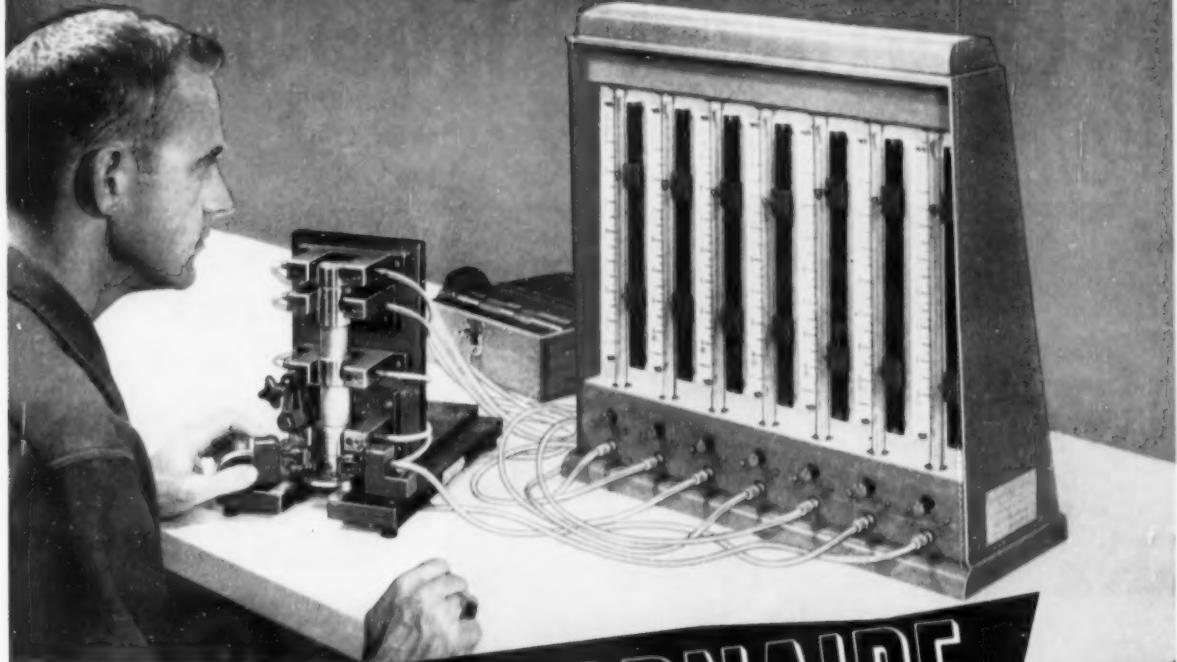
*for the best buy  
... buy Bath*

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**JOHN BATH & CO., Inc.**  
28 Mann St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS • INTERNAL MICROMETERS

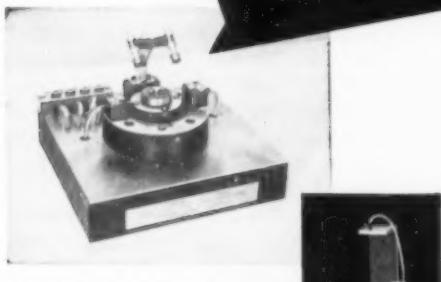
# Speed Inspection OF PRODUCTION PARTS!



NEW

## DEARBORNAIRE

### MULTIPLE COLUMN AIR GAGING INSTRUMENTS



Special Air Gaging Fixtures  
designed and built to meet your  
particular application require-  
ments. Complete engineering  
service available upon request.

Send part print showing all  
dimensions to be checked and  
tolerances required for prompt  
quotation and delivery.



To speed inspection of production parts, new Dearbornaire air gaging instruments are now offered in multiple column units designed to permit more accurate simultaneous checking of as many dimensions as may be required for a given part. What's more, each unit incorporates all of the advanced design features which have made Dearbornaire the most practical, most versatile column type instrument ever produced . . .

- New higher rated pressure system and built-in circuit restrictions make them virtually self-cleaning, reduce maintenance to a minimum.
- New glass tube has a characterized internal taper which provides positive linear accuracy over the full extent of the calibrated scales.
- Easy-to-read Zero-centered scales permit use of instrument for normal inspection, statistical quality control, and as a tool setting gage.
- Interchangeability of component parts simplifies conversion from one amplification to another, reduces spare parts inventory costs.

Plus a complete line of air gage spindles, rings, snaps and cartridges all precision finished to give you greater accuracy, longer wear life. Free demonstration arranged upon request. Write for details today!

AIR GAGE DIVISION  
**DEARBORN GAGE COMPANY**  
22038 Beech Street • Dearborn, Michigan

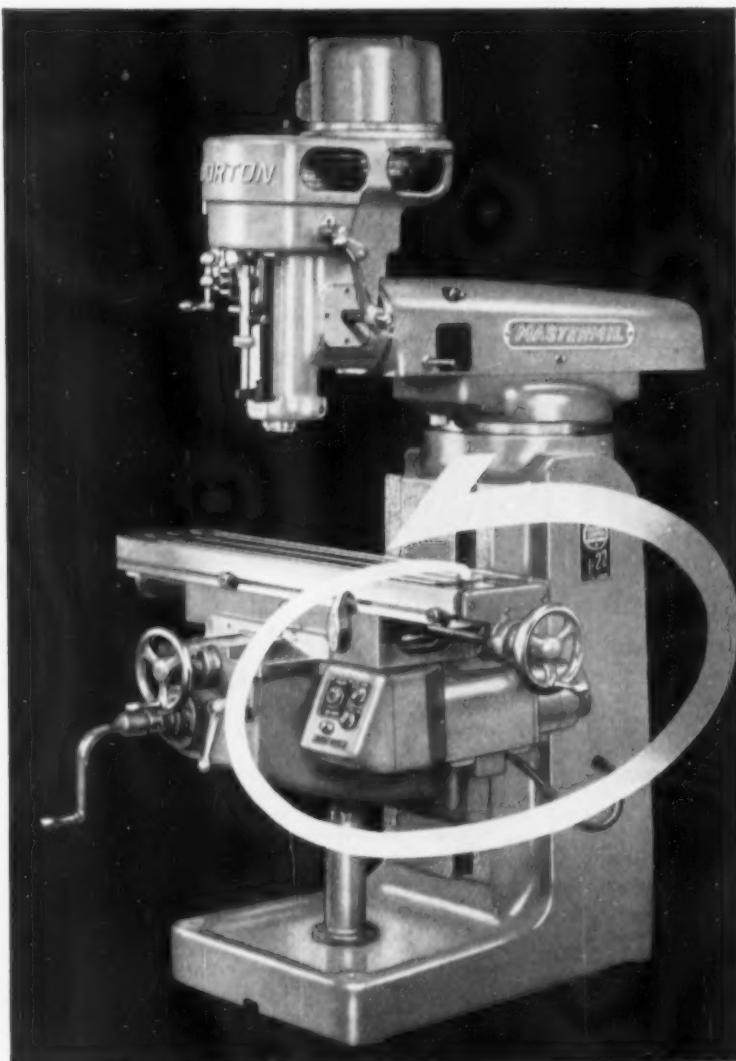


For the first time — on any milling machine

# ELECTRONIC DYNADRIVE

REGISTERED TRADE MARK

THE "TORQUE-THINKING" TABLE FEED



Yours  
EXCLUSIVELY  
with  
**GORTON**  
**MASTERMIL**

*It "feels" . . .  
as it feeds*

• The exclusive Gorton Dyna-Drive® Table Feed unit "thinks while it works." It automatically adjusts to provide the exact amount of torque required. This electronic "brain" compensates during the cutting operation for small variation in density, hardness and molecular structure of the material being machined. Results are exceptionally fine finish and prolonged cutter life.

The Gorton Mastermil is precision-built throughout, simple, rugged with the finest milling head of any machine in its class. Ram adjusts in and out. Turret revolves and spindle swivels 90° left or right.

Learn more about this  
remarkable machine  
by writing for  
bulletin 2699-A-2611



GEORGE **GORTON** MACHINE CO.

2611 RACINE STREET

RACINE, WISCONSIN

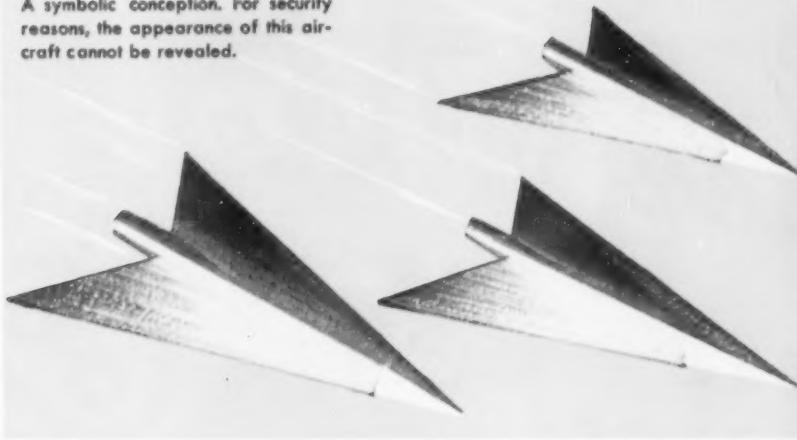
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SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and  
Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

A7-1003-1P

A symbolic conception. For security reasons, the appearance of this aircraft cannot be revealed.



### In building the supersonic Arrow . . .

Avro Aircraft, Limited saves time and money with

## EPON® RESIN

dies, tools, jigs, molds and fixtures

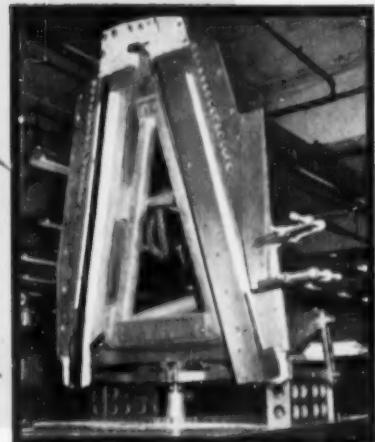
Avro Aircraft, Limited—developing Canada's supersonic Arrow—is achieving major savings with Epon resin tooling.

Epon resins provide faster, lower cost preparation of stretch dies, forming tools, drop hammer dies, jigs, duplicate master die molds, checking and assembly fixtures. Avro reports that in making dies of Epon rather than metal, manpower requirements are two-thirds less, which is reflected in correspondingly great savings in the unit cost of tooling.

The Epon resins have an ideal combination of properties for tooling applications. To list just a few:

- Exceptional dimensional stability, high impact strength, excellent resistance to abrasion, minimum residual stress in cured parts.
- Ease and speed of preparation.
- Low shrinkage in filled formulations, assuring perfect master reproduction; minimum warping and stresses.
- Adaptability to repairs and design changes.
- Minimum finishing requirements for smooth surfaces.

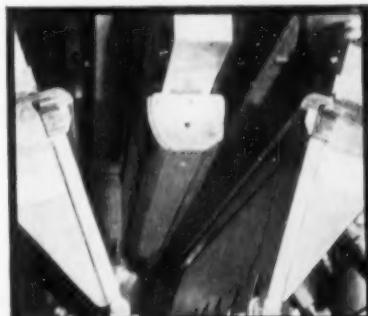
Like Avro, other leading manufacturers report savings as high as 80% with Epon resin tools and dies—for production as well as experimental and short-run work. Can you make comparable savings in your own operations? Find out by writing for technical literature on Epon resins for tool and die applications.



A master drill and setting gauge, showing use of Epon resins to duplicate compound curves and contours.



Epon-faced die requires only hand rubbing to achieve smooth finish. Radii are being touched up with sander.



Stretch die, with Epon resin facing of involved contours, ready for run on 800-ton press.

## SHELL CHEMICAL CORPORATION

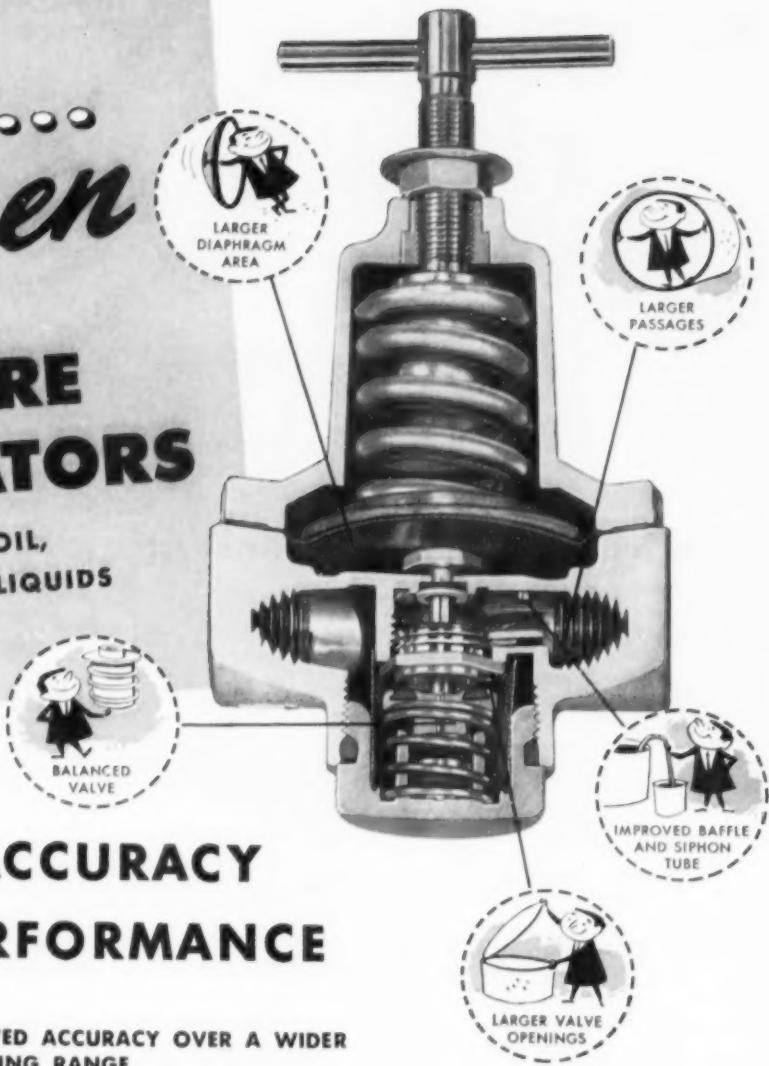
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**PRESSURE**  
**REGULATORS**

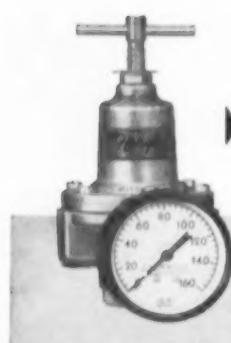
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The American Seating Company of Grand Rapids, Michigan, needed a precision surface 50 feet in length, accurate within 5 thousandths of an inch over the entire area, on which to inspect the aircraft wing spars and aluminum castings they are producing for a large aircraft manufacturer.

The answer was easy! Challenge supplied five of their standard Sectional Assembly Layout Surface Plates each 10 feet in length. When keyed and bolted together, these "exclusive" Challenge units, each accurate within .002", provide an overall accuracy of .005 of an inch. Another advantage for American Seating is the flexibility of these units! If the production needs change, the sections can be taken apart and used separately, or new sections can be added as needed.

This is just one example of how Challenge has helped many manufacturers solve their precision surface requirements. Challenge has the broadest line of precision surface equipment and Challenge factory specialists are available to work with you on your needs. So, if you have an inspection, assembly or manufacturing problem involving precision surfaces, check first with Challenge.

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for a complete Catalog of Challenge Standard Precision Surface Equipment — including Semi-Steel and Granite Surface Plates, Semi-Steel V-Blocks, Angle Plates, Floor Plates, etc. . . .



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# Up to 40% higher tightening torques keep a

—and only the combination of an UNBRAKO screw

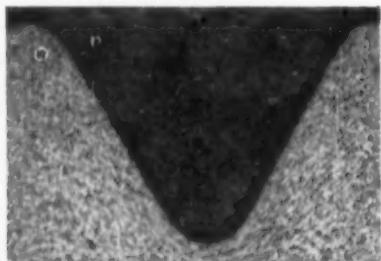
## RECOMMENDED SOCKET SET SCREW TIGHTENING TORQUES (Inch-Pounds)

SCREW SIZE	UNBRAKO	SET SCREW B	SET SCREW C	MINIMUM DIFFERENTIAL %
#4	5	3.9	3.5	28
#5	9	7.8	7.4	15
#6	9	7.8	7.4	15
#8	20	14.7	14.5	36
#10	33	26.5	25	25
1/4	87	62	60	40
5/16	165	122	125	32
3/8	290	198	225	29
7/16	430	309	350	23
1/2	620	460	500	24
5/8	1225	1106	1060	11
3/4	2125	1540	1800	18
7/8	5000	3660	4600	9
1	7000	5025	6500	8

The High-Torque UNBRAKO socket set screw is made to withstand the highest tightening torques ever used to seat a set screw—up to 40% higher than an ordinary set screw. But to take full advantage of this UNBRAKO feature you must have a key that can apply the force required to seat it without damaging the screw or snapping the key. The High-Titan UNBRAKO hex key is designed specifically to set a High-Torque UNBRAKO so that you can be assured of full *high-torque* performance every time.

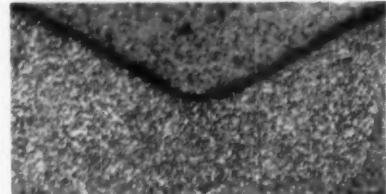
## Here's why a High-Torque UNBRAKO can be seated tighter—and stay put

### UNBRAKO SET SCREW



It has fully formed threads that make the whole screw stronger. The metal is compressed into the closely knit grain structure that you see in this illustration. The grain flow follows the contour of the threads. There are no straight lines along which shear can occur. The UNBRAKO retains its flow lines even when ground down to .010 in. below root diameter. Screws with cut or ground threads lose thread form at root diameter.

### UNBRAKO SET SCREW



The High-Torque UNBRAKO has a radius in the socket corners. This eliminates the sharp corners where cracks start. It also distributes the stresses developed when tightening torques are applied. Ordinary socket screws have sharp corners which often crack when tightened even at lower torques than those recommended for UNBRAKO.

### UNBRAKO SET SCREW



### ORDINARY SET SCREW



The High-Torque UNBRAKO has a deeper socket, which gives you more purchase with the wrench. Since more wrench can be put into the UNBRAKO socket, you can set the screw much tighter. And you won't ream the socket or round the corners of the wrench.

### UNBRAKO SET SCREW



The High-Torque UNBRAKO is properly heat treated, kept clean. Its grain structure is uniform. It is free of decarburization. There's no danger of stripping the threads or shearing the point when tightening

# High-Torque UNBRAKO socket set screw tight

and key assures full high-torque performance

## ORDINARY SET SCREW



torques are applied. The ordinary screw is suffering from an overdose of decarburization; socket walls, threads and point

are full of the telltale white spots that identify it.

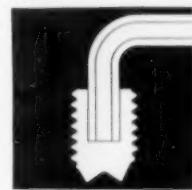
And here's why an UNBRAKO High-Titan hex key can be used to apply far more tightening torque to a High-Torque UNBRAKO socket set screw than is needed without damaging either the screw or the key.

The High-Titan UNBRAKO is not an ordinary hex key. It is a precision internal wrenching tool with high ductility, specially designed to assure full high-torque performance. It is made of special alloy steel bar stock, inspected magnetically and chemically to make sure that the material is flawless and of the specified properties. Its sides are flat and parallel. The corners,

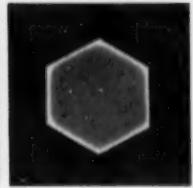
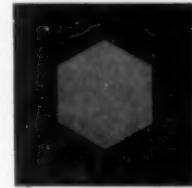
which exert torque on the inner walls of the socket, are sharp and tough. The bend is strong.

The High-Titan UNBRAKO is accurately sized across the flats and across the corners to insure snug fit and full wall contact. It won't ream or wear an UNBRAKO socket. The square cut end engages the full depth of the socket for greater tightening power. It gives you up to 25% more wrench engagement than a key with a chamfered end.

## UNBRAKO KEY

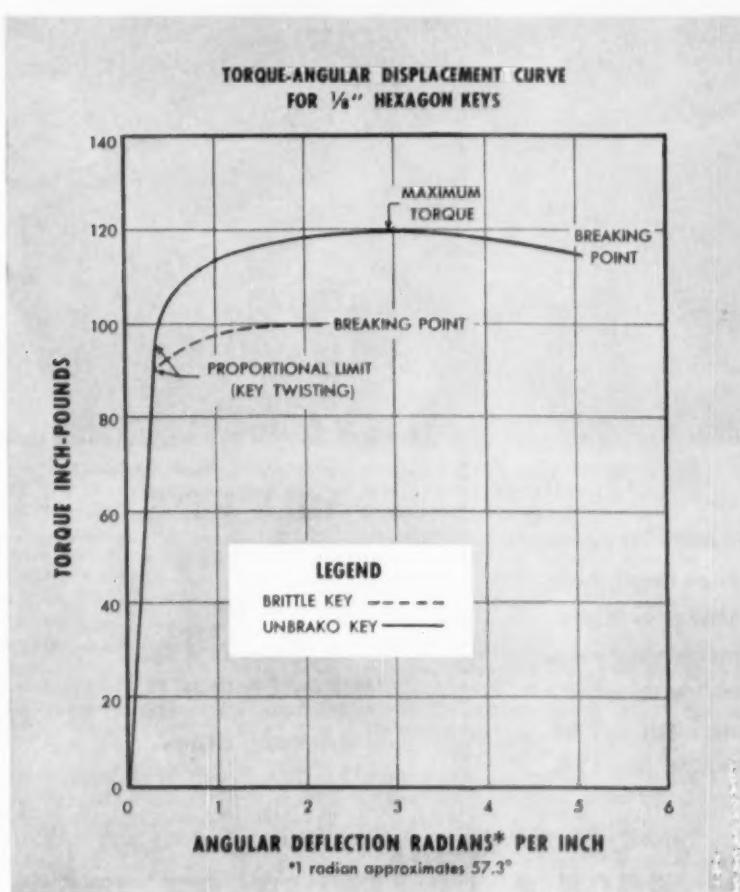


## CHAMFERED END KEY



The High-Titan UNBRAKO hex key is heat treated in modern atmosphere-controlled furnaces. The surface is casehardened without decarburization. The extra hard surface gives the key longer life. And it retains its dimensional accuracy, is tougher and more ductile than ordinary keys. This torque-angular displacement curve for  $\frac{1}{8}$  in. hexagon keys distinguishes a High-Titan UNBRAKO from an ordinary key. The High-Titan UNBRAKO has a higher yield point and a higher breaking point—you can exert a much higher torque with it without snapping the key.

Be sure you get the full high-torque performance offered only by the combination of a High-Torque UNBRAKO socket set screw and a High-Titan UNBRAKO hex key. Both products are stocked by authorized industrial distributors. Ask the one nearest you for complete information. Or write STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.



We also manufacture precision titanium fasteners. Write for free booklet.

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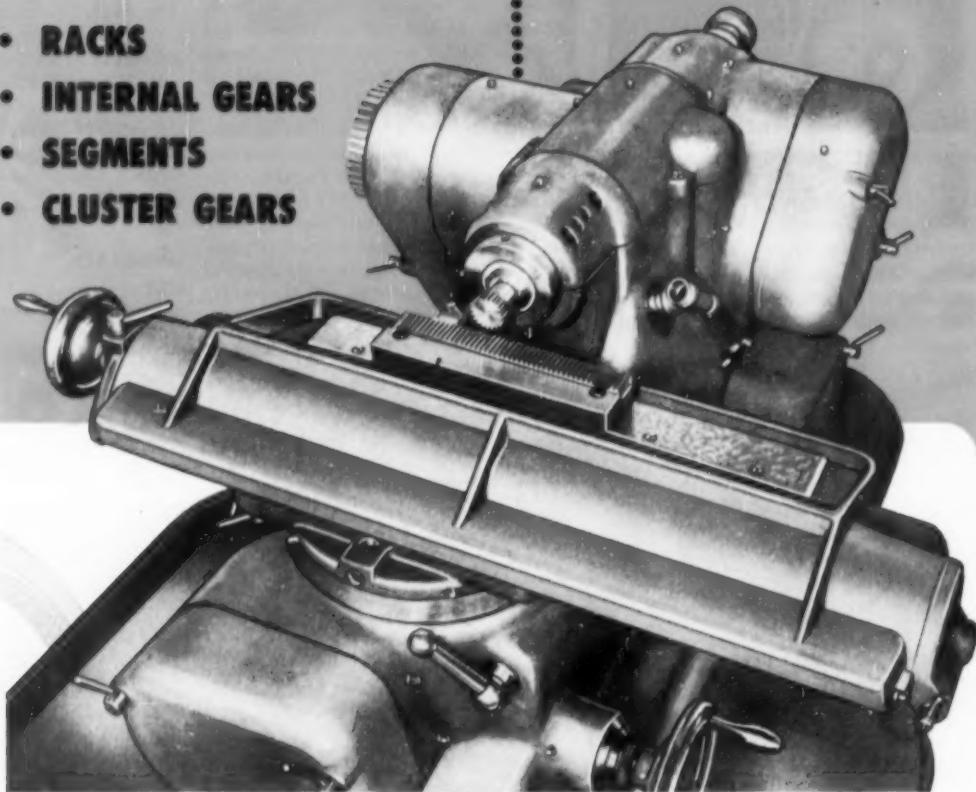
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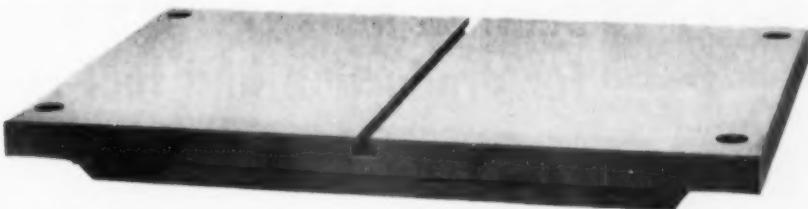
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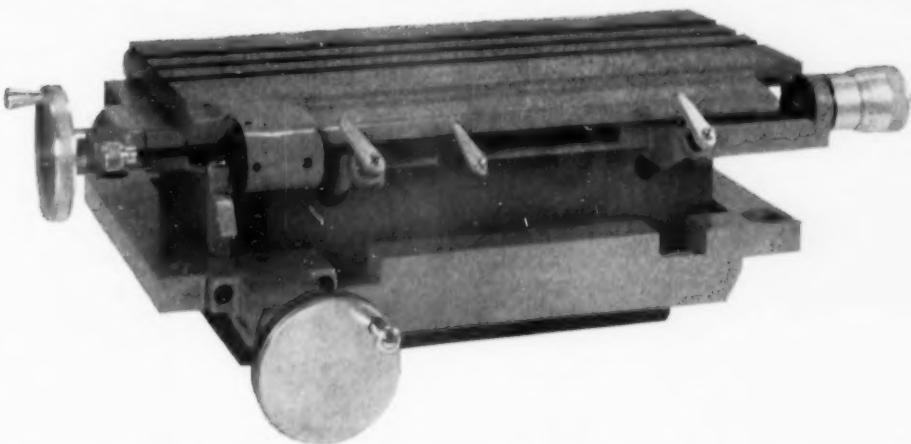
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# NOW...CHOICE OF WORKTABLES



## WITH THE KODAK CONTOUR



## PROJECTOR, MODEL 14-6

To meet a wide range of your optical gaging needs, the Kodak Contour Projector, Model 14-6, is now available with a choice of worktables: a flat, fixed staging table for production-line gaging and a movable worktable for horizontal toolroom measurements.

### With the fixed table you have...

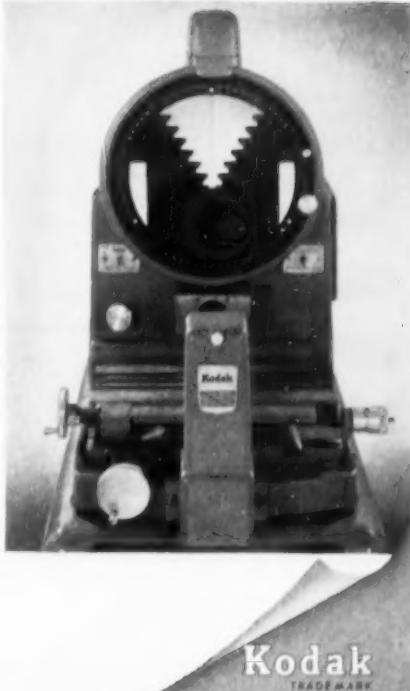
- An inexpensive instrument for checking long production runs quickly and accurately.
- Ease of adaptability to your own special staging fixtures. Fixtures are positioned in a milled T-slot, and the image is brought into focus by moving the fixture along the slot.
- Ample staging area for many kinds of parts, with  $19\frac{1}{2}''$  x  $13\frac{1}{4}''$  table, throat clearance of  $14\frac{1}{4}''$  and lens height of  $6\frac{1}{8}''$  above the table.

### The movable table gives you...

- Easier fixturing and faster setups with table cross travel of 3", vertical travel of 2", focusing travel of  $1\frac{1}{2}''$ .
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With the Model 14-6 you get a high-quality precision optical system. A full 14-inch viewing screen covers a field of  $1.4''$  at  $10\times$  magnification. Accessory lenses provide a range of magnifications to  $100\times$ .

For additional data or a demonstration of this new Kodak Contour Projector, write to:



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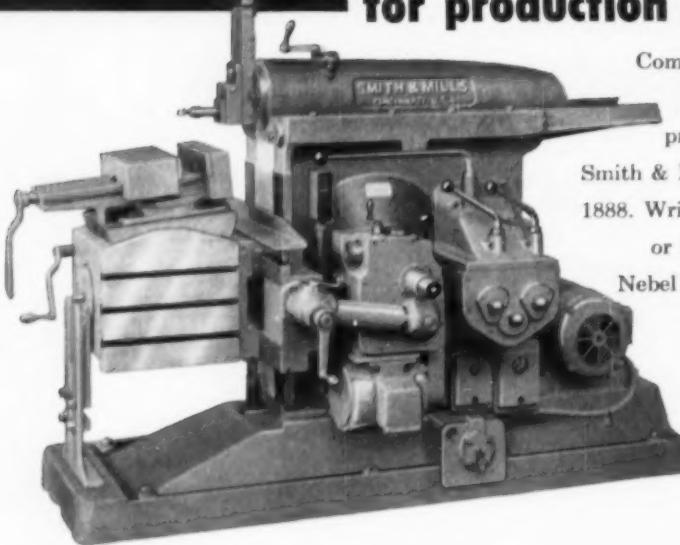
Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

**the KODAK CONTOUR PROJECTOR**

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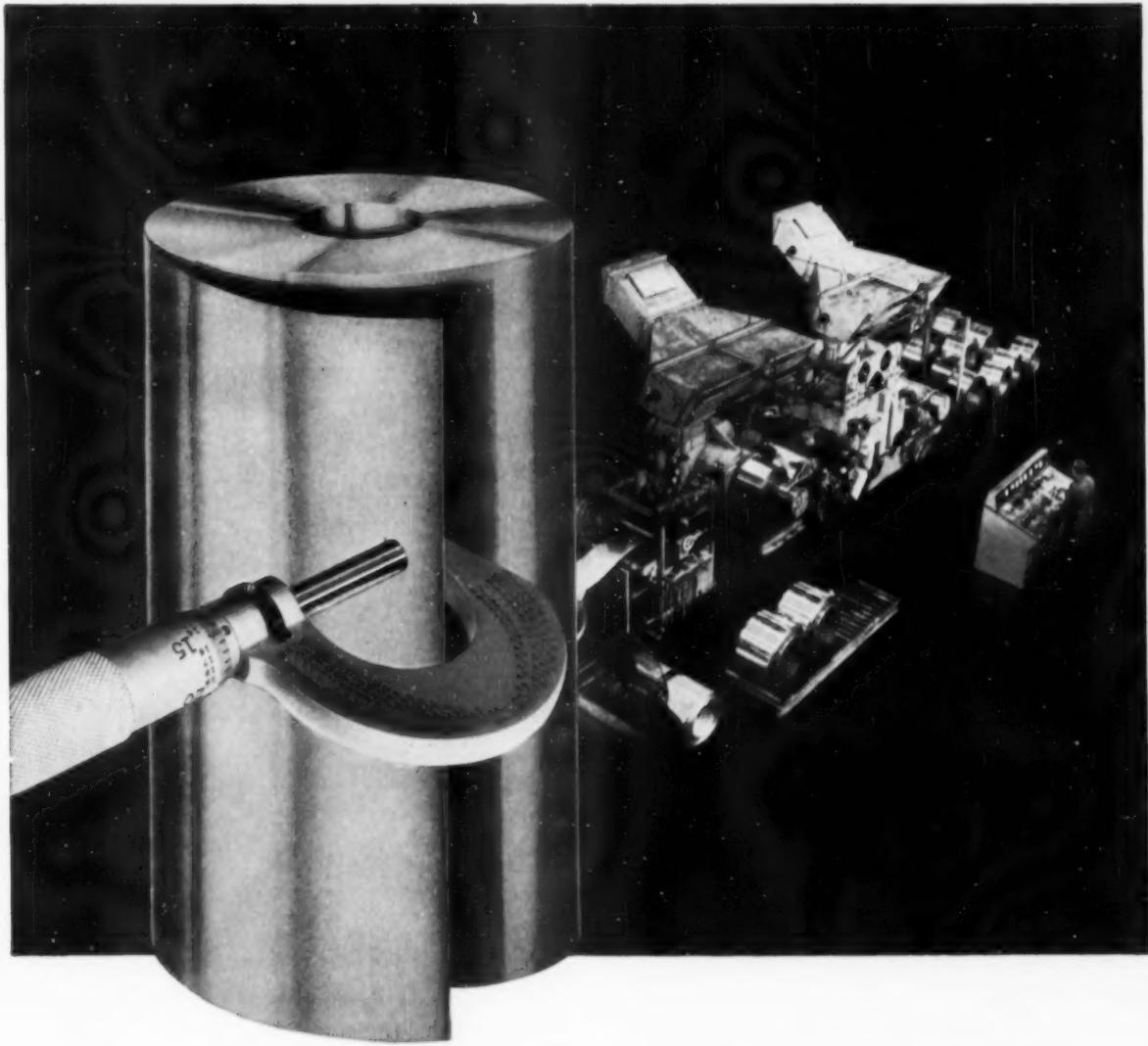
in inch grams  
...inch ounces  
...inch pounds  
...foot pounds



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# When Brass Strip Tolerances Call For PERFECTION TO THE "N<sup>th</sup>" DEGREE



Possibly, you've never seen—or even heard of—a Sendzimir Rolling Mill like the one pictured above. Not many people have. But if you use close-tolerance brass, copper or bronze strip, you'll certainly appreciate what these high-speed, precision units can do when you order Bridgeport Sendzimir-Rolled Strip.

These mills—now in operation at Bridgeport's plants—are capable of rolling light-gauge strip into economical, long-length coils to meet the most rigid gauge tolerances.

Bridgeport Sendzimir-Rolled Strip has other advantages as well. It has remarkable uniformity of gauge and mechanical properties from edge to edge and end to end. It also has a beautiful luster—all properties you can use to advantage in your own production.

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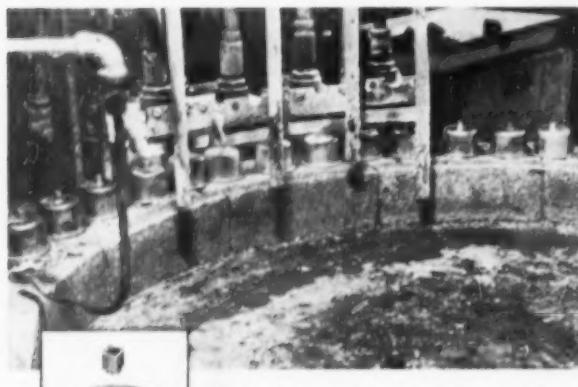


Table Lighter Cup — Spindle and cup are "painted" with a rich mixture of 180-mesh EASY-FLO 45 and HANDY FLUX in paste form. They are placed on revolving table which passes them under four gas-air burners in a 15-second heating cycle. The closing-spring latch is joined to the top of this lighter by torch brazing with EASY-FLO 45 Rod.



Pocket Lighter Top Assembly — This consists of the lighter top, wick housing, flint housing and cover spring housing, and requires three brazed joints. Parts are first assembled and dipped in HANDY FLUX. Next, operators place a single wire preform (EASY-FLO 45) which covers all three joints. Brazing is automatic as table carries assemblies under burners.

## How RONSON Makes Cigarette Lighters by the Hundred Thousand with EASY-FLO 45 Brazing

### TAKE A LOOK

... at Bulletin 20. This concise introduction to silver alloy brazing talks about joining methods, as well as joint design and economies that can be enjoyed with EASY-FLO brazing. We'll send you a copy whenever you request it.



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The Tool Engineer



Photo courtesy The Monarch Machine Tool Company

**THE LATHE** — Monarch Series EE Model 1000 Precision Lathe

**THE OPERATION** — The turning of a stub shaft

**THE CHUCK** — Horton, of course

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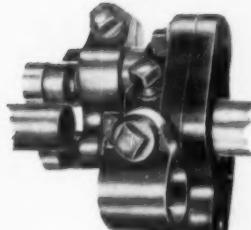
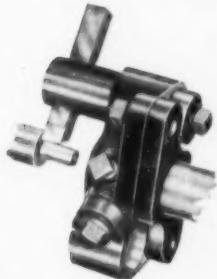
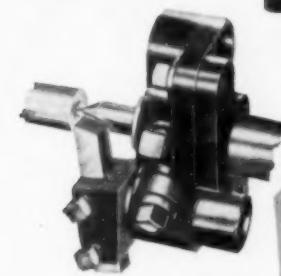
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**GEOMETRIC TOOL COMPANY DIVISION**  
**New Haven 15, Connecticut**



# R and L

## TURNING TOOL

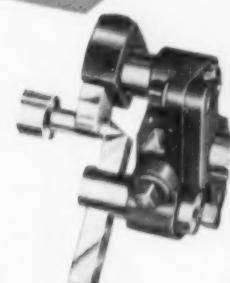
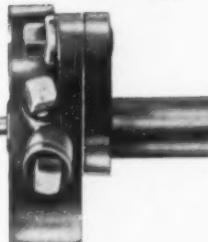
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	\$267.00
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**COMPANY**

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*One 25-ton and five 15-ton Denison hydraulic Multipresses make up SMP's body press line . . . where rifle grenade bodies are progressively drawn to cone shape with flat end.*



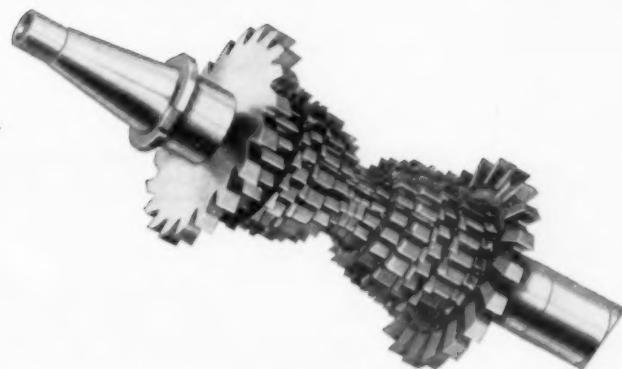
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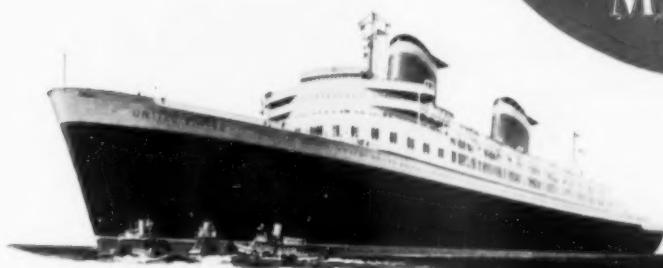
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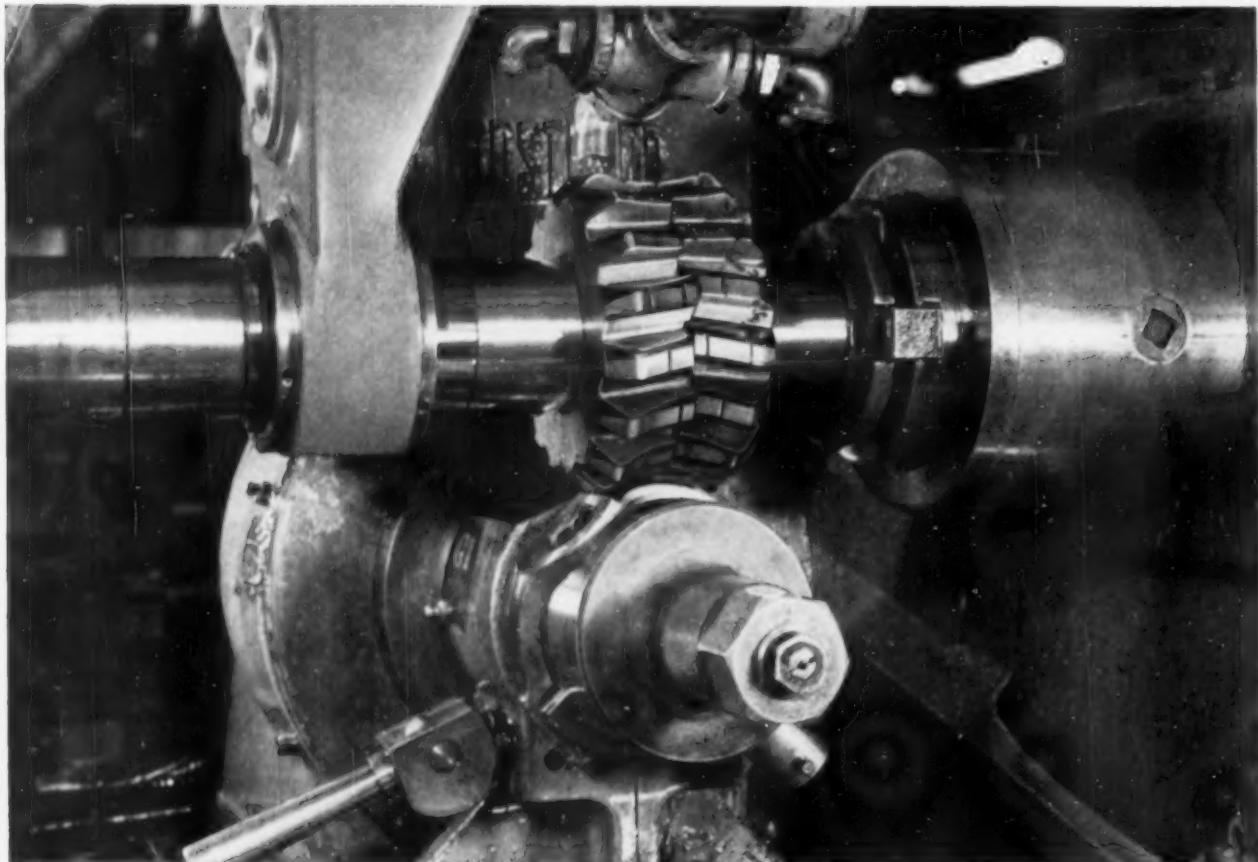
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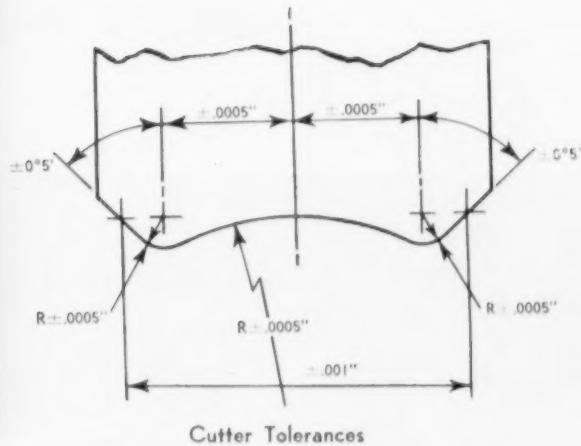
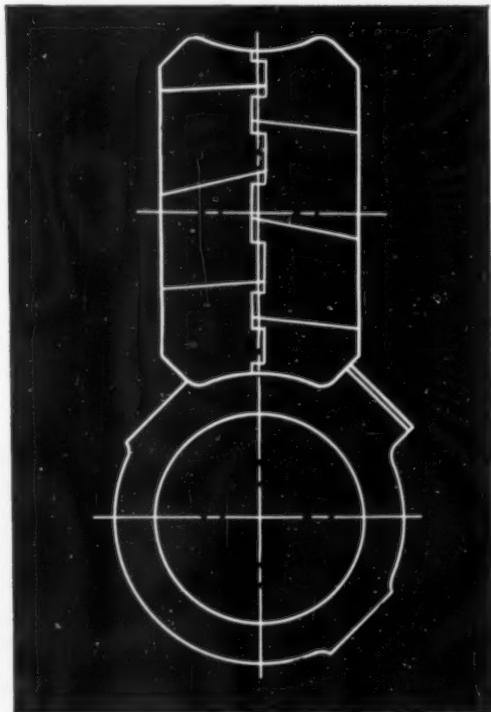
7693

*milling efficiency*   
*in tough steel calls for*  
*expert cutter design*

 **interlocking cutter with helical flutes  
in both directions provides positive cutting  
action in high alloy steel**

 **ground form-relieved cutter provides  
required accuracy for this aircraft part**





Accurate milling of this high alloy steel part for Sundstrand Aviation requires a combination of expert cutter design and precision cutter manufacture. To accomplish this job, Barber-Colman engineers designed a ground, form-relieved, interlocking cutter which is 6" in diameter.

Since the material is tough alloy steel for an aircraft part, the cutter is made in two interlocking sections so that each half of the cutter can have helical flutes in opposite directions. This design provides positive axial rake on the angular portion of each half of the cutter, resulting in a shearing action as each side enters the cut. In addition, the alternate tooth design provides maximum overlap for smooth cutting action and fine finish. A free flow of chips is obtained by the combination of the opposite-hand helical flutes and the alternate teeth.

The form on this cutter is ground to hold the close tolerances required on the part. Each of the radii is held to a tolerance of  $\pm .0005"$ . The width of each half from the center of the radius

to the center of the cutter is held to  $\pm .0005"$ , with an overall tolerance of  $\pm .001"$  when the cutter sections are assembled. The form must fit the layout within  $.0005"$ , and this tolerance is inspected to include the effect of axial and radial runout. Accurate tolerances such as these can be provided for your parts by Barber-Colman ground form-relieved cutters.

A fine finish is obtained using a feed of .980 inches per minute and a speed of 80 SFM. The tolerance for finish is 125 RMS. Approximately 200 inches of this tough steel are milled per sharpening.

Results like these are evidence that when you are milling tough materials requiring accuracy and finish, expert cutter design and manufacture are essential for cutting efficiency and good tool life. Consult Barber-Colman cutter engineers on your milling cutter requirements. Their long experience and manufacturing knowledge can save you production time and costs.

**BARBER-COLMAN COMPANY**

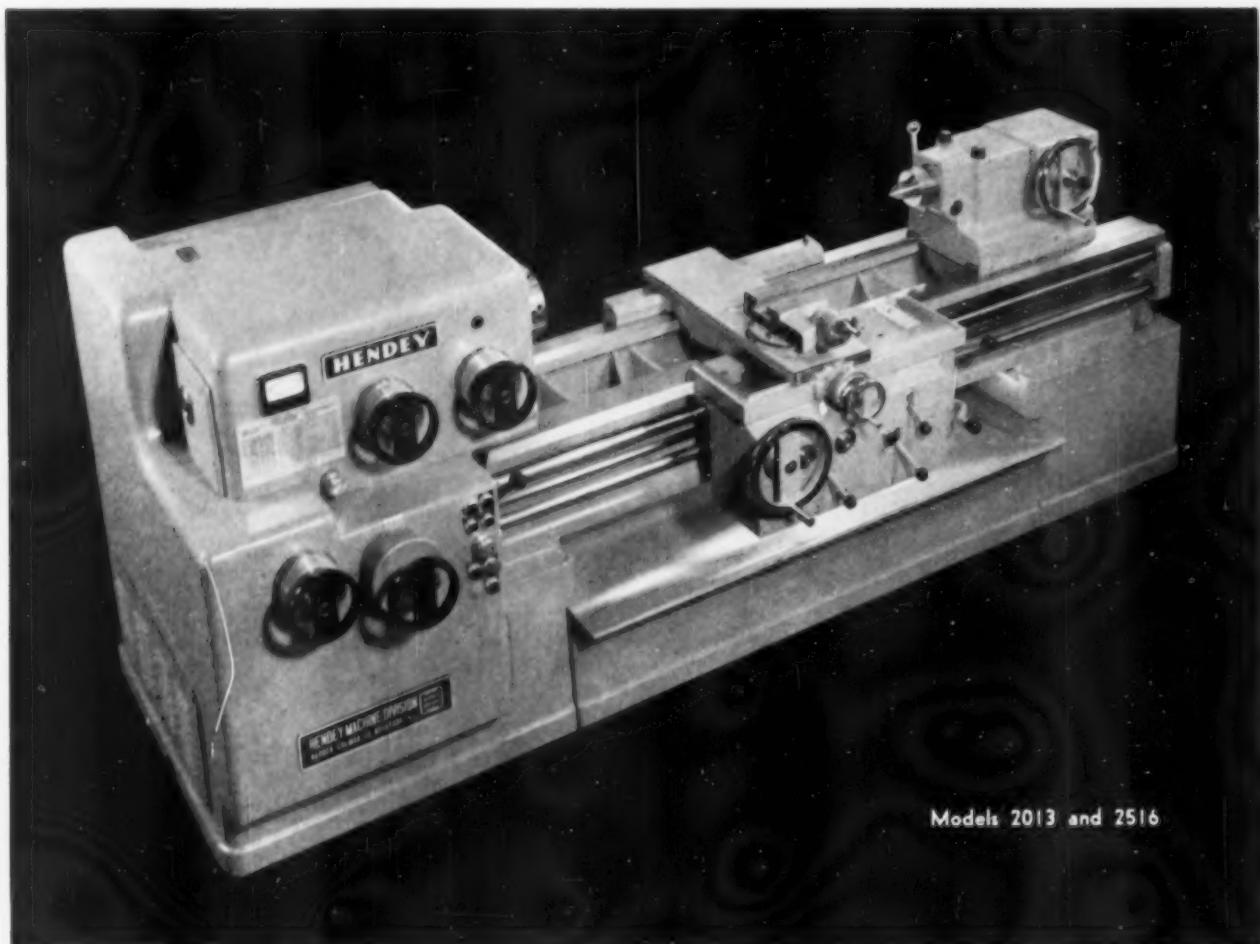
8811 ROCK STREET • ROCKFORD, ILLINOIS

*Hobs • Cutters • Reamers • Hobbing Machines • Hob Sharpening Machines*



**NOW! FROM HENDEY...**

**all new 32-speed**



Models 2013 and 2516

*More rigidity, more threading features, more lathe per dollar!*

## geared-head lathe

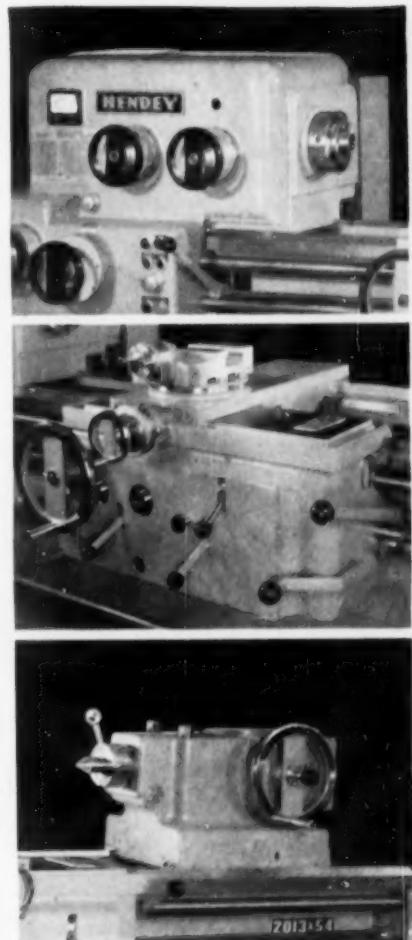
Here are the all-new Hendey No. 2013 and No. 2516 lathes, with a 32-speed geared head (up to 2000 rpm), a complete line-up of threading features, and heavy-duty design combined with toolroom precision. The 32-speed headstock transmission contains crowned, flame-hardened spur gears which are automatically lubricated. You select speeds simply by shifting gears. Greatly simplified mechanical design gives you lower maintenance costs — more machine, dollar for dollar, than any other lathe in its class.

Three sets of super-precision tapered roller bearings support the spindle at both ends and in the middle, increasing accuracy and improving finish. An automatic spindle adjuster eliminates any manual adjustment of the spindle bearings regardless of the spindle speed.

The extra-heavy bed casting is made of dense, wear-resistant semi-steel, which is induction-hardened and ground on all way surfaces. Lathes can be furnished with a 15, 20, or 25 hp spindle drive motor and come equipped with a load meter and automatic overload release for the carriage feed.

Hendey has all the threading features, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 feed and thread changes, with 2 to 120 quick-change threads per inch and feed range from .0015 in. to .091 in. per revolution, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to the half nuts.

Compare these tailstock features with other lathes on the market: Weighing almost 400 lb, the tailstock can be positioned quickly and easily with one hand. And the ways under it are hardened and ground. Large 4½ in. diameter spindle has a full 10 in. extension, with slow and rapid traverse speeds.



**Hendey** machine division  
BARBER-COLMAN COMPANY  
113 Loomis St., Rockford, Illinois





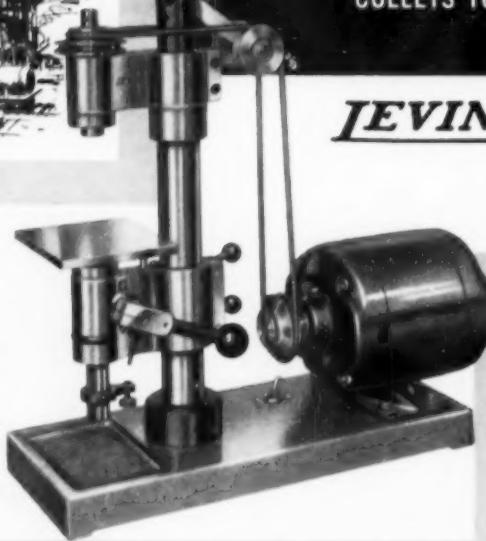
## EQUIP FOR THE SIZE OF THE JOB

SMALL DRILLS MUST BE HELD IN PRECISION  
COLLETS TO ASSURE ACCURACY

**LEVIN** <sup>®</sup> MICRO DRILL PRESS  
FOR VERY SMALL HOLES  
DOWN TO .002"

### SPECIFICATIONS:

Size of table is 3-3/4" x 4". Maximum table travel is 1-1/2". Greatest distance between table and end of spindle 4". Preloaded ball bearing spindle with four speeds 1725, 2600, 3000, 4700 RPM. Motor 1/2 HP, 110V, 60C. The micro drill press may also be had with a 3450 RPM motor, doubling the above speeds.



In the LEVIN micro-drill press drills are held in precision collets. Runout is reduced to practically zero and drill breakage from this cause is eliminated. Collets are available in a complete range of sizes down to .1 mm (.004"). Send for catalog M describing complete line of micro-drilling equipment, collets, instrument lathes and precision tools. Louis Levin & Son, Inc., 3610 S. Broadway, Los Angeles 7, California.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-11-286-1

You Can Use Full  
Working  
Tolerances  
WITH  
*Em-re*  
DIAL  
INDICATORS



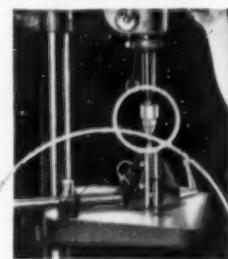
With "Em-re" Dial Indicators operators can always use their full working tolerances. These indicators are so accurate—and have such consistent repeatability—that there is never any need to make allowances for inherent inaccuracies or sluggishness. Tolerances read on the indicator itself can be exactly the same as those specified. "Em-re" .0001" indicators, for example, are accurate to within .00002". All "Em-re" Dial Indicators are fully jeweled—with the exclusive "Em-re" 100% shockproofing system that actually contributes to the greater accuracies obtained. Stocked in 29 models, 8 ranges from .002" to 1.000"; graduations in .00005", .0001", .00025", .0005" and .001". Also available for accurate indicator testing—the "Master" Dial Indicator Checker.

Write for Catalog D.

**PETZ-EMERY INC.**

PLEASANT VALLEY, NEW YORK

USE READER SERVICE CARD, INDICATE A-11-286-2



### AMAZING TWIN TOOLS

•  
**INCREASE  
DRILL  
PRESS  
PRODUCTION**

*AMF Wahlstrom Automatic Keyless Chuck:* Convert 95% of lost tool-changing time to productive time. A single chuck does the work of several spindles. The greater the load, the tighter the grip. No stopping of the spindle to change tools.

*AMF Float-Lock Instant Change Vise:* Positive anchoring on drill press table. *Floats and Locks* in any position. Holds work safely for accurate drilling and tapping.

Write for details and name of nearest distributor.

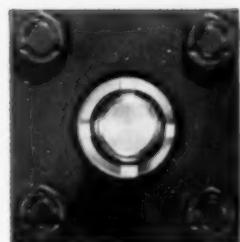
AMF Tool Division

**AMERICAN MACHINE & FOUNDRY COMPANY**

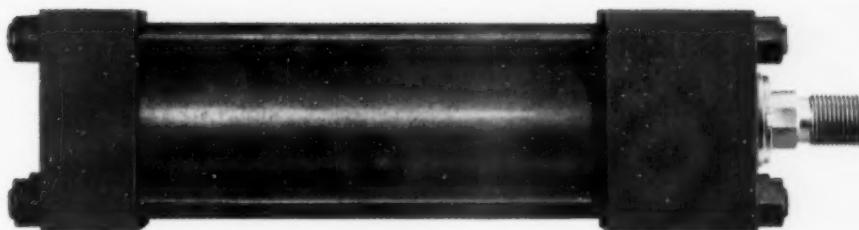
224 Glenwood Avenue, Bloomfield, N. J.

USE READER SERVICE CARD, INDICATE A-11-286-3

The Tool Engineer



## Made for the tough buyer



**The discriminating engineer** is intolerant—intolerant of anything but the very best in his plant and in his product.

For these tough buyers Hannifin cylinders are made. Into these cylinders go original, exclusive features of design, precision manufacture, and the ability to outperform others with the very minimum of maintenance.

You would expect to pay more for Hannifin cylinders. Actually there is no price premium. We can deliver them to you promptly in the sizes and mounting styles you require.

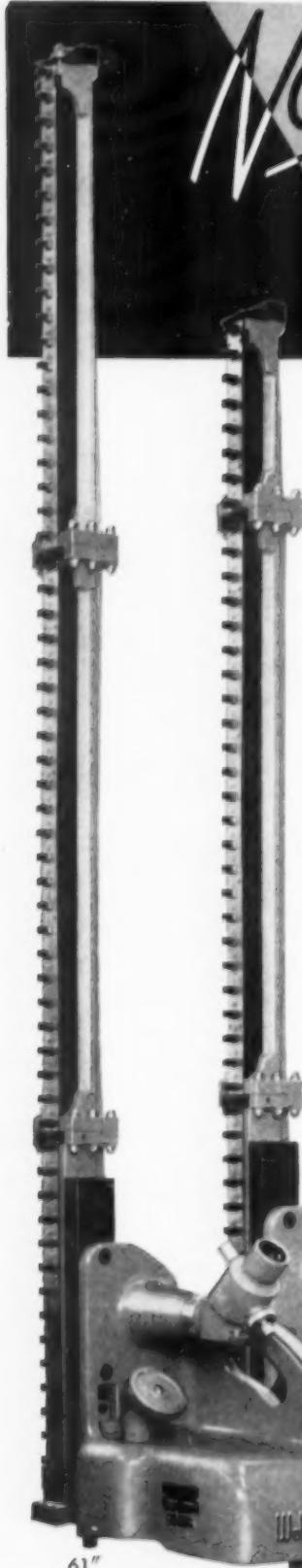
AIR AND HYDRAULIC

**HANNIFIN**

POWER CYLINDERS

Write for your copy of this new Hannifin Cylinder File—complete, easy-to-use, easy-to-order-from information on five lines of Hannifin cylinders. Hannifin Corporation, 519 South Wolf Road, Des Plaines, Illinois.





*Now*

A COMPLETE LINE

of the Revolutionary New

# WEBBER OPTICAL HEIGHT GAGES

25" - 37" - 49" - 61"

Combining two proven principles of precision measurement — WEBBER Gage Blocks and the Leitz Measuring Microscope —

THE WEBBER OPTICAL HEIGHT GAGE has made it possible, for the first time, to make measurements in millionths, up to a full 61" of height. Its fantastic accuracy is maintained throughout the entire length of the instrument,  $\pm .000005"$  per inch of length.

Simple to use, fast, accurate, the WEBBER Optical Height Gage introduces a new era of manufacturing accuracy. The saving of time, the accelerated rate of production, and the resultant increased profits make it vitally important that every manufacturer who is conscious of today's trend toward even greater precision get the facts about this revolutionary new measuring instrument.

Your inquiry is invited.

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25"

37"

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61"

Webber  
MICROACCURATE  
Gages

LARGEST EXCLUSIVE MANUFACTURERS OF GAGE BLOCKS

## Here's Why Continental Counterbore Drives Never Bind ! Never Fail !

Continental Counterbores operate precision smooth and detach with a twist of the wrist because the driving forces generate compressing not shearing action in the holder. They never bind, deliver long-lasting, trouble-free operation.

In Continental Counterbores, you get extra torsional rigidity because drive lugs are close to the seating shoulder of the cutter. Double lugs on the

cutter engage double abutments in the holder to form a powerful tool. But best testimony to the satisfaction you get from these counterbores is this: no one has ever reported failure of a Continental Counterbore Drive! For more information, call your local Ex-Cell-O Representative or write to Continental Tool Works in Detroit. Available individually or in a choice of three sets.



**CTW** **Continental** **TOOL**  
**WORKS**  
DIVISION OF  
EX-CELL-O CORPORATION, DETROIT 32, MICHIGAN

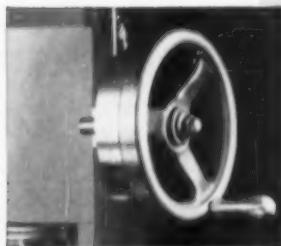
**FOOTBURT**

# Accurate grinding for small parts

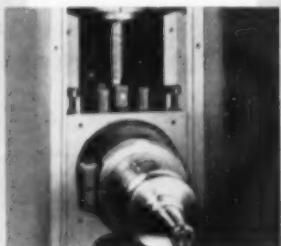
The Hammond No. 2, 6" x 18", Surface Grinder is a precision tool room machine for use on the most accurate gauge and tool work. The standard spindle is direct motor driven and is mounted on precision preloaded ball bearing. Total vertical adjustment is  $10\frac{1}{4}$ ". In and out movement of table is  $6\frac{1}{2}$ " with a longitudinal travel of 18".

**THE FOOTE-BURT COMPANY • Cleveland 8, Ohio**

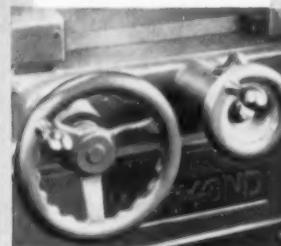
Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.



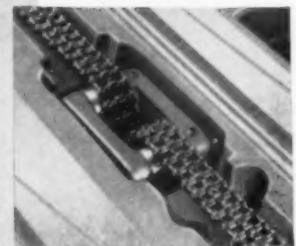
**Accurate Spindle Adjustment**  
— Standard vertical adjustment of spindle through handwheel is  $.0005"$ . With Vernier attachment, spindle can be raised accurately to  $.00005"$ .



**Solidly Supported Spindle Carrier**—Spindle carrier is moved vertically on double dovetail ways with adjustable tapered gibbs.



**Convenient Hand Control**—Handy wheels for cross travel, accurately gauged to thousandths, and quick acting longitudinal travel.

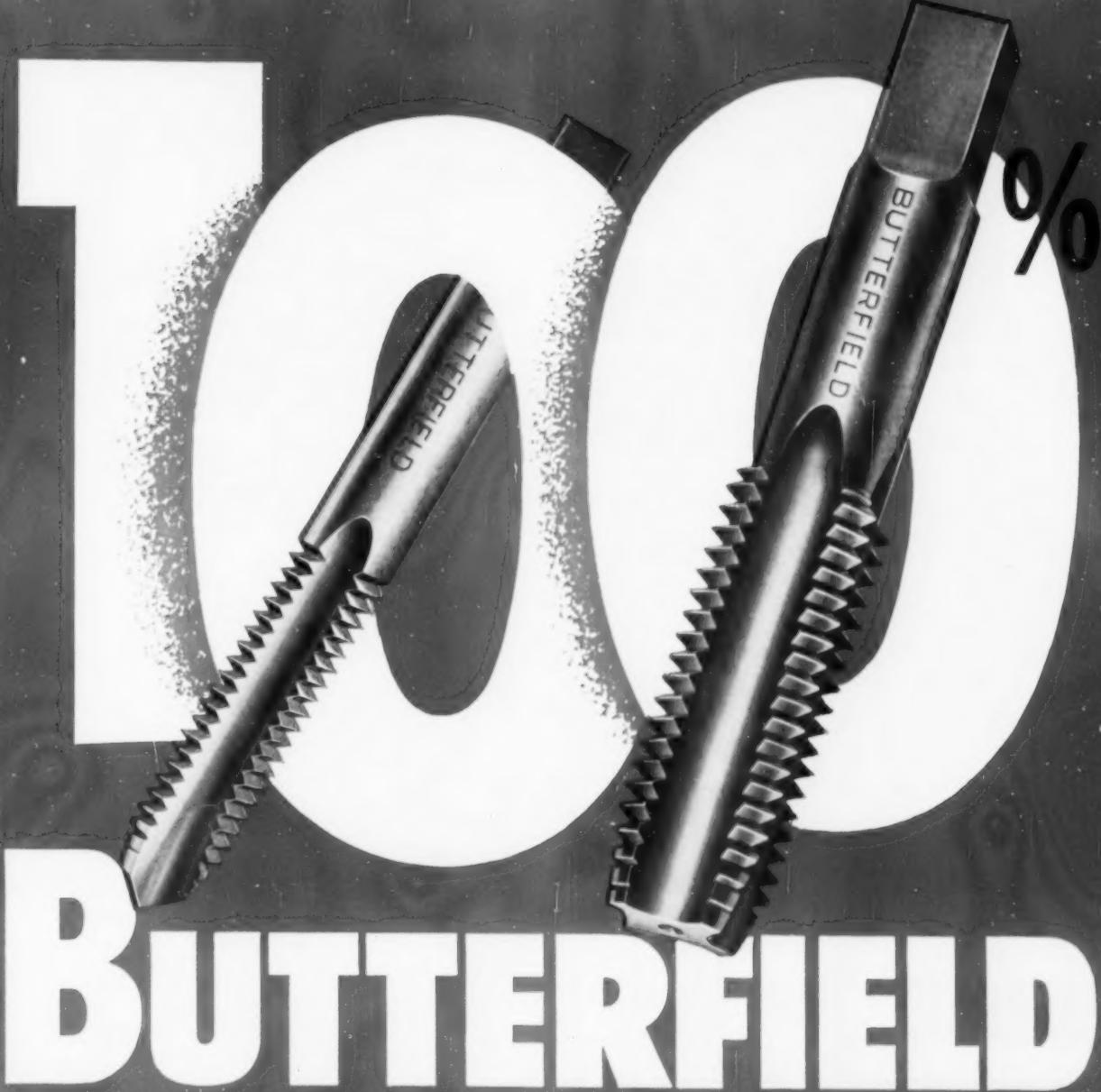


**Smooth Roller Chain Table Drive**—Remarkably smooth finish on work, without chatter marks frequently found when table is moved by conventional means through rack and pinion.

**FOOTBURT**

**S U R F A C E   G R I N D I N G**

Write for  
Circular #13A.



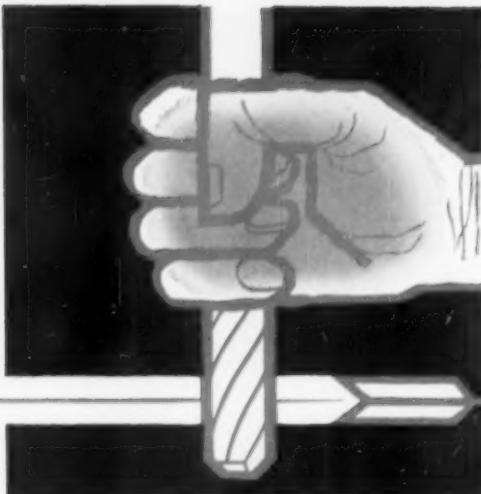
# BUTTERFIELD

**100% Complete Line... Every Tool 100% Inspected**

**and you get 100% SERVICE**

**FROM YOUR BUTTERFIELD DISTRIBUTOR**

Butterfield also offers a complete line of taps, dies, drills, reamers, cutters, end mills, hobs and carbide cutting tools. There are Butterfield warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York, San Francisco. BUTTERFIELD DIVISION • Union Twist Drill Company • Derby Line, Vermont.

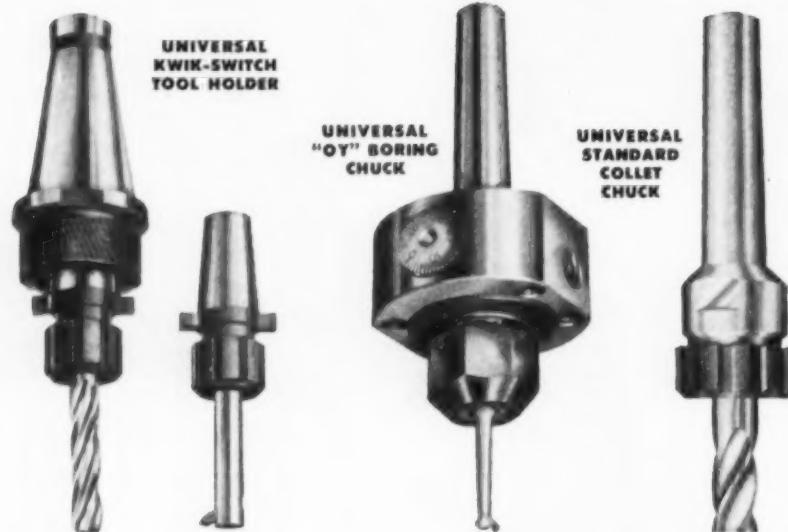


positive  
grip

and true-running

tools

## ARE CERTAIN WITH UNIVERSAL CHUCKS SUCH AS THESE:

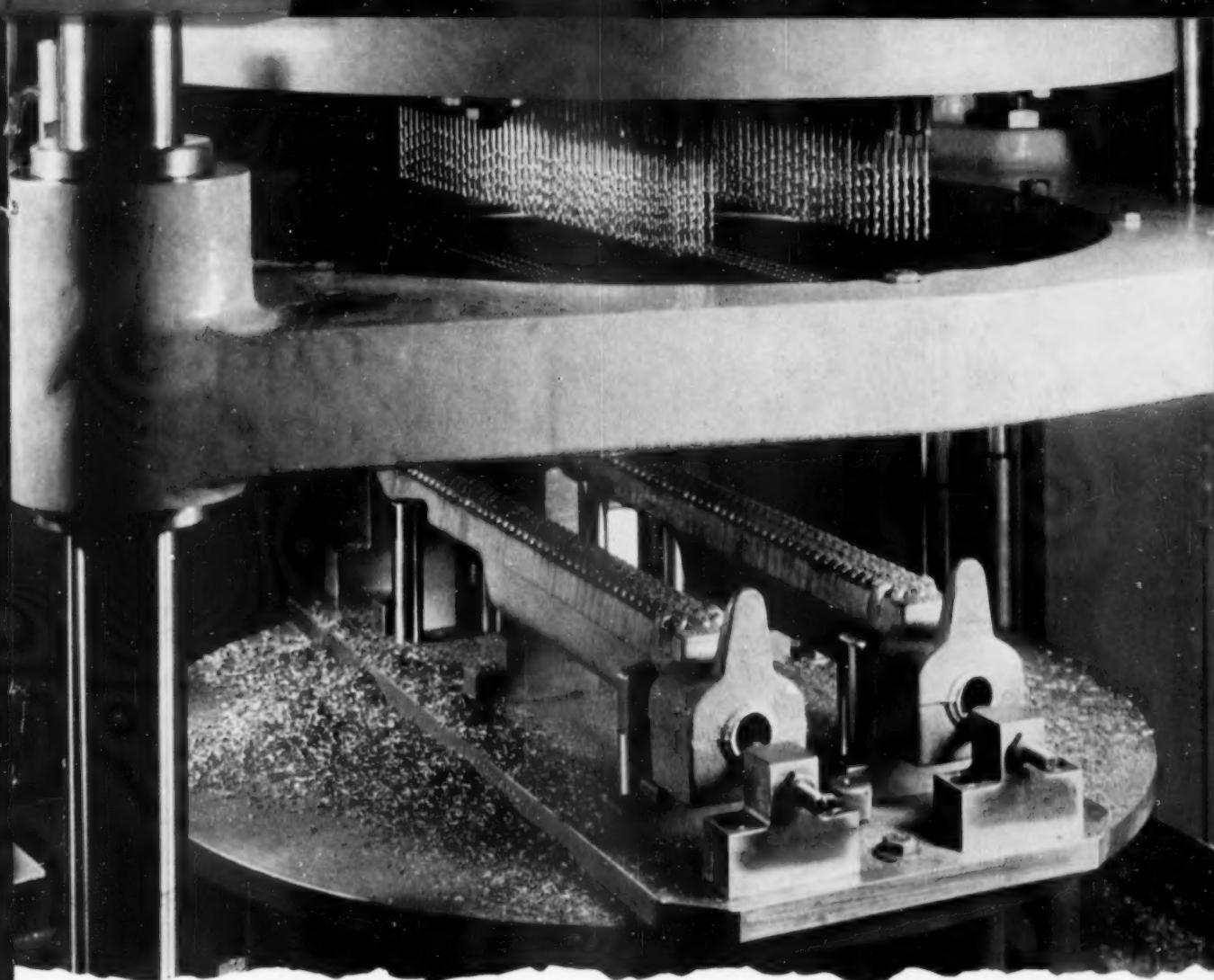


A sure, solid grip on tools is provided by the wrap-around action of Universal chucks because the slotted collet grips the tool on a continuous surface the full length of the collet. This positive grip, plus the precision manufacturing of all Universal chucks, keeps tools running true to .001" within an inch from the nose of the chuck. Our simplified chuck

design eliminates auxiliary bearings, resulting in low cost to you. Sizes range from  $\frac{1}{16}$ " to  $1\frac{1}{2}$ ", with shanks to fit any machine. For complete information on these three or other Universal chucks, write the office nearest you: Universal Engineering Sales Co., 1060 Broad St., Newark, N. J., 5053 Sixth Ave., Kenosha, Wis., or our home office in Frankenmuth.

**UNIVERSAL  
ENGINEERING  
COMPANY**

FRANKENMUTH 3, MICHIGAN



Uniform quality  
and high performance of  
**CLE-FORGE** High Speed Drills  
can help you reach  
production quotas

## **COSTLY "DOWN TIME" REDUCED!**

• You can keep your drilling operations *on schedule* with CLE-FORGE High Speed Drills. These fine quality tools give superior performance on *every set-up* . . . and you can rely on their *uniformity* day after day, month after month, year after year.

◊ Why not ask a Cleveland Service Representative for suggestions on reducing "down time" and increasing production in *your* shop? Contact our nearest stockroom, or . . .

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E. P. Barres, Ltd., London W. 3, England



# New NOPAK Team

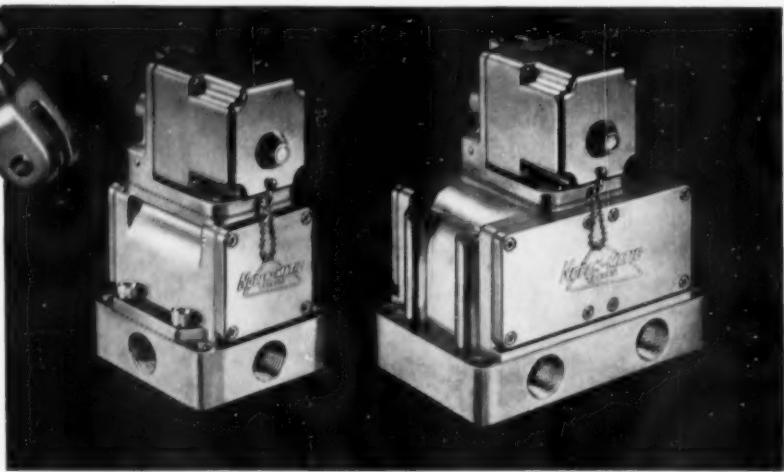
## delivers PLUS VALUES in Air Power!

NOPAK Air Cylinders, long known for their dependability and economy, now can be applied to even greater advantage with the new Nopak-matic pilot operated air control valves. Full flow design and dependable performance make NOPAK Cylinders and Nopak-matic control valves the perfect "team" for "in plant" or O.E.M. applications. They deliver Plus Values that you can measure in terms of greater speed, higher efficiency, easier maintenance, a wider range of adaptability and versatility.

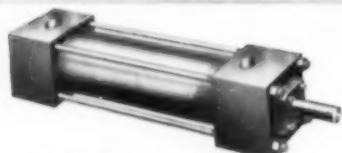
- **NOPAK** Class 1 and 2 Cylinders are available in 7 standard mountings in bore sizes from  $1\frac{1}{2}$ " to 14" with a choice of non-cushioned, self-regulating or adjustable cushioned heads on all models.

- Nopak-matic, Pilot-operated, Poppet-type Air Control Valves are available in  $\frac{1}{4}$ ",  $\frac{3}{8}$ ",  $\frac{1}{2}$ " and  $\frac{3}{4}$ " pipe sizes for 2- or 3-Way normally open or normally closed operation, and 4-Way operation with master (air), single or double solenoid control heads. All 4-Way valves available, as standard, with choice of side or bottom ported sub-plates. Air pressures to 150 p.s.i.

Catalog 101-A and Catalog 105 provide complete descriptive and engineering data.



## Other NOPAK Products for your Fluid Power Needs



- **CLASS 3 CYLINDERS**—for pressures to 2000 p.s.i. Compact steel plate square head and tie-rod construction. Honed steel tubing. Heads may be cushioned or non-cushioned. Available in 14 standard mounting styles.



- **CLASS 4 CYLINDERS**—High Pressure Hydraulic—Heavy, honed steel tubing with lock-ring flange construction. For hydraulic (oil) service at line pressures to 3000 p.s.i. Choice of cushioned or non-cushioned heads. Available in 5 standard mounting styles.



- **CLASS M CYLINDERS (Mill Type)** Welded flange construction, with honed steel tubing, eliminates tie-rods. Recommended for all types of Heavy Duty air or hydraulic pressures up to 650 p.s.i. depending upon diameter.

The NOPAK line includes cylinders and valves for a wide range of fluid power application—and its precision control. In addition to standard air cylinders, there are heavy duty, mill-type cylinders, square head and lock-ring flange type hydraulic cylinders. The NOPAK Valve line includes the famous packless rotating disc valves in both hand and foot models, high pressure hydraulic valves, Flotrol speed control valves and reciprocating valves.



- **NOPAK 2-, 3- AND 4-WAY HAND VALVES** are used to control single or double-acting cylinders at air or hydraulic line pressures to 250 p.s.i. Precision lapped seal eliminates packing, prolongs valve life. Disc rotating at right angle to stream flow permits throttling action or immediate opening to full pipe area. Pipe sizes from  $\frac{1}{4}$ " to 2".

**NOPAK 2-, 3- AND 4-WAY FOOT VALVES** incorporate all of the features of NOPAK hand operated disc-type valves including the lapped-disc design and packless construction. They are available in 3 types which are adaptable to a wide variety of control needs. Pipe sizes from  $\frac{1}{4}$ " to 1" for pressures to 125 p.s.i.



- **NOPAK FLOTROL SPEED CONTROL VALVES** provide uniform control of cylinder speed in one direction free flow in the other. Features: quick, easy, precision adjustment without tools; greater capacity; easy installation because of compact in-line design; fit in tight places; made of rust and corrosion proof materials. Pipe sizes from  $\frac{1}{4}$ " to 1".

Write for Catalog SW-3

# NOPAK

GALLAND-HENNING NOPAK DIVISION • 2750 South 31st St. • Milwaukee 46, Wis.

A7-618-1P

# PIONEER ALUMINUM INC.

announces new

# 921-T

DIRECT CHILLED

## CAST ALUMINUM TOOLING PLATE

UNIVERSALLY ACCEPTED  
FOR PRECISION LOW COST  
TOOL ENGINEERING IN ALL  
METAL WORKING INDUSTRIES

AVAILABLE  
ALL OVER THE  
UNITED STATES  
...through leading metal suppliers



**PIONEER ALUMINUM INC.**

SUBSIDIARY OF MORRIS P. KIRK & SON, INC. PACIFIC COAST UNIT OF NATIONAL LEAD CO.  
5281 W. IMPERIAL HIGHWAY • LOS ANGELES 46, CALIFORNIA

EASTERN SALES OFFICE: 12430 Michigan Avenue, Dearborn, Michigan

**Direct Chilled 921-T Cast Aluminum Tooling Plate** is here, in sizes up to 60 inches wide, 192 inches long and 12 inches thick. Made exclusively by Pioneer Aluminum Inc., the new material is manufactured under processes which control solidification and provide greater density, less porosity and higher mechanical properties to augment the characteristics of standard 921-T.

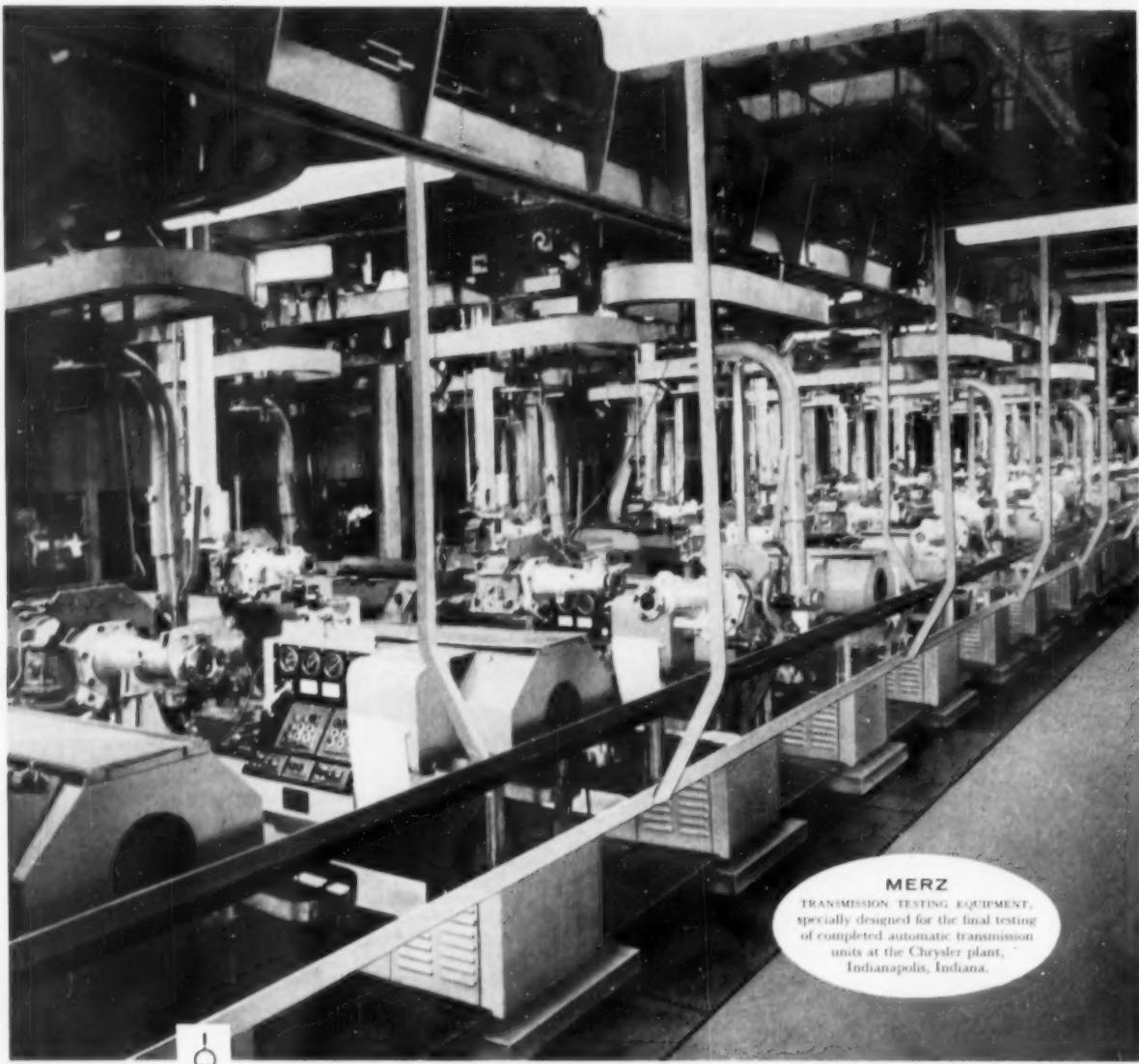
Pioneer 921-T Cast Aluminum Tooling Plate meets every precision tooling requirement, and at lower cost. Its stability, versatility and workability save money and man-hours, being easily sawed, tapped, milled or welded. All Pioneer Cast Aluminum Tooling Plate\* is guaranteed within  $\pm .005"$  in thicknesses over  $\frac{1}{4}"$ . Write or call any Pioneer distributor for details, prices and engineering data.

\* Sizes up to 88" wide, 192" long, 12" thick, cast by the new Pioneer DIRECT CHILLED process.

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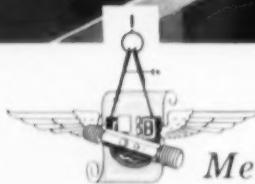
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TRANSMISSION TESTING EQUIPMENT,  
specially designed for the final testing  
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*Merz Precision Testing Equipment on the Job*

Day after day, with clock-like precision, America drives to work . . . and millions of automobile transmissions put on a mass demonstration of precision in action. Stop and go . . . faster, then slow . . . they silently shift from gear to gear, smoothly and automatically. Yet, few drivers are aware of the prominent role played by Merz Engineering in this daily precision performance. Today, in the automotive industry, in aviation, in every phase of manufacturing where the keyword is *precision*, Merz-engineered equipment is pre-testing to assure high quality precision performance

in everything mechanical, from automobile transmissions to jet airplanes.

Always in step with the latest engineering developments, Merz is designing and building electronic gaging and testing equipment to measure the precision and efficiency of today's most complex mechanisms. For over 20 years, Merz Engineering has specialized in the manufacture of testing instruments, accurate up to ten-millionths of an inch, that enable you to maintain high standards of precision control. Let Merz transform your ideas into time and labor-saving equipment.



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Ford increases press efficiency

with

**McKay**

mechanical feed lines



To increase the output and efficiency of large presses the Ford Motor Company has installed a McKay Mechanical Press Feed Line that for the first time successfully cleans, levels, and feeds heavier materials for today's production requirements. Designed to process strip up to 60" in width and 1/8" in thickness, it works equally well on progressive die or blanking presses without overloading. And, because it is floor-mounted with independent drive it can easily be adapted to future production needs.

If you want to increase the efficiency of your press equipment, why not talk with McKay—pioneer and leading producer of press feed and cut up lines.



THE MCKAY MACHINE COMPANY, Youngstown, Ohio

242

**FREE BOOKLET**

Complete illustrated data on McKay Press Feed and Cut Up Equipment will be mailed without charge at your request. Write for it today.



# Talide Tools... PROVED BEST BY TEST!

**COSTS ONLY \$1.65** Leading appliance manufacturer gets superior results with Talide standard brazed-type tool.

Machine..... Gisholt Turret Lathe.

Part..... Stud for automatic washing machine 3/4" dia. x 4"

Operation..... long, 1045 Steel, Rockwell 28 "C".

Tool..... Complete finishing including threading of end.

Speed (S.F.M.)..... Standard Talide tool AL-10-5/8" sq. x 4", Grade S.90.

Average No. of pcs. per grind..... 400 Feed .005"

Average No. of regrinds per tool..... 16 Depth of Cut .003"

Tool..... 600 Talide Grade S.90 Next Best

Speed (S.F.M.)..... 475 Premium Grade

14

90 DAYS OF GRUELING TESTS at eastern aircraft engine plant rates Talide Grade S.92 "Best by Test."

Here is one typical result:

Machine..... 36" Bullard Multimatic

Material..... AMS-5613 Stainless Steel

Operation..... Facing, turning and boring 21" O.D. x 2.5" thick casting to size. (Heavy scale, bead weld, and out of round surfaces presented adverse machining conditions.)

Tools..... TN-163P3 (1/2" I.C.) and SN-243P3 (3/4" sq.)

Speed (S.F.M.)..... Talide "Throw-away" triangular and square inserts. 375 to 1000 Feed .006" to .012"

Depth of Cut..... .060 to .500

Result..... 27.34 P.c. average compared to 7.12 for next best premium grade—plus tool breakage cut 75%.

## BEST CUTTING METAL FOR MACHINING CRANKSHAFTS

A large midwest automotive plant recently conducted an extensive test to determine the best cutting metal for machining crankshafts—the results proved TALIDE "BEST BY TEST!"

Machine..... Fay Automatic Lathe Feed .006"

Speed..... 800 R.P.M. Depth of Cut .035"

Cutting Tool..... Style TB-12123 Triangular Insert

Material	Talide Grade S.90	2nd Best Carbide	3rd Best Carbide
1141 Steel	175 pcs.	120 pcs.	97 pcs.
4140 Steel	128 pcs.	70 pcs.	65 pcs.
Armor Steel	83 pcs.	65 pcs.	65 pcs.

## CONSTANT RESEARCH PAYS OFF!

Year after year Talide metal improves in hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces under rigid laboratory control—all Talide grades are uniform and consistent in quality.

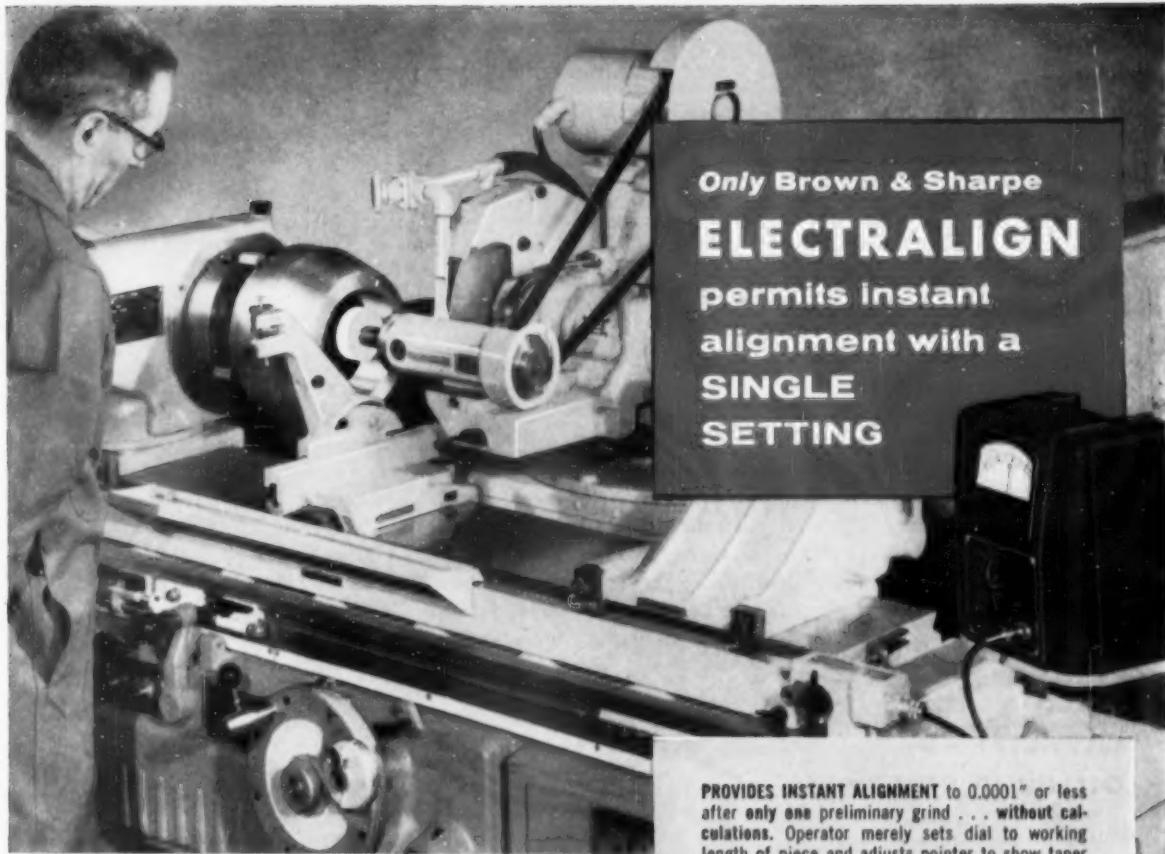
Call in a Talide sales engineer to recommend proper tooling for your machining operations, or write for 76-page catalog No. 56-G. METAL CARBIDES CORPORATION, 6001 Southern Blvd., Youngstown 12, Ohio.



KLAMP LOK TOOLHOLDER INSERTS



HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS  
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS.  
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with ELECTRALIGN — and many other exclusive advantages  
— are setting cost-reduction records. Write for details.

*"How much time does it save the operator?"* That's the true test of the Brown & Sharpe ELECTRALIGN or any other comparable electronic aligning device for grinding machine swivel tables.

ELECTRALIGN has a 10-year record of *proved savings of 60% or more in set-up time*, on all types of cylindrical and taper grinding.

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PROVIDES INSTANT ALIGNMENT to 0.0001" or less after only one preliminary grind . . . without calculations. Operator merely sets dial to working length of piece and adjusts pointer to show taper error. He then swivels table until pointer reads zero, and grinds to finish — with practically full tolerance for sizing.

AUTOMATICALLY COMBINES AND AMPLIFIES the electrical signals from the measuring elements at both ends to give one easily-read meter deflection proportioned to the angular movement of the swivel table only. Operator is relieved of need to compensate for deviation at each end individually.

A DEPENDABLE "WATCHDOG" that indicates any change in original alignment requiring readjustment. Alignment can be instantly restored.

AMPLIFIER SERVES DOUBLE DUTY — Can also be used with Electralign Comparator Selector (base) to permit electronic caliper measurements to 0.00001", without removing work from machine. Converts from alignment to gaging simply by turning the Selector switch.



**SAVES  
60%  
or more in  
SET-UP TIME**

# REHNBERG-JACOBSON

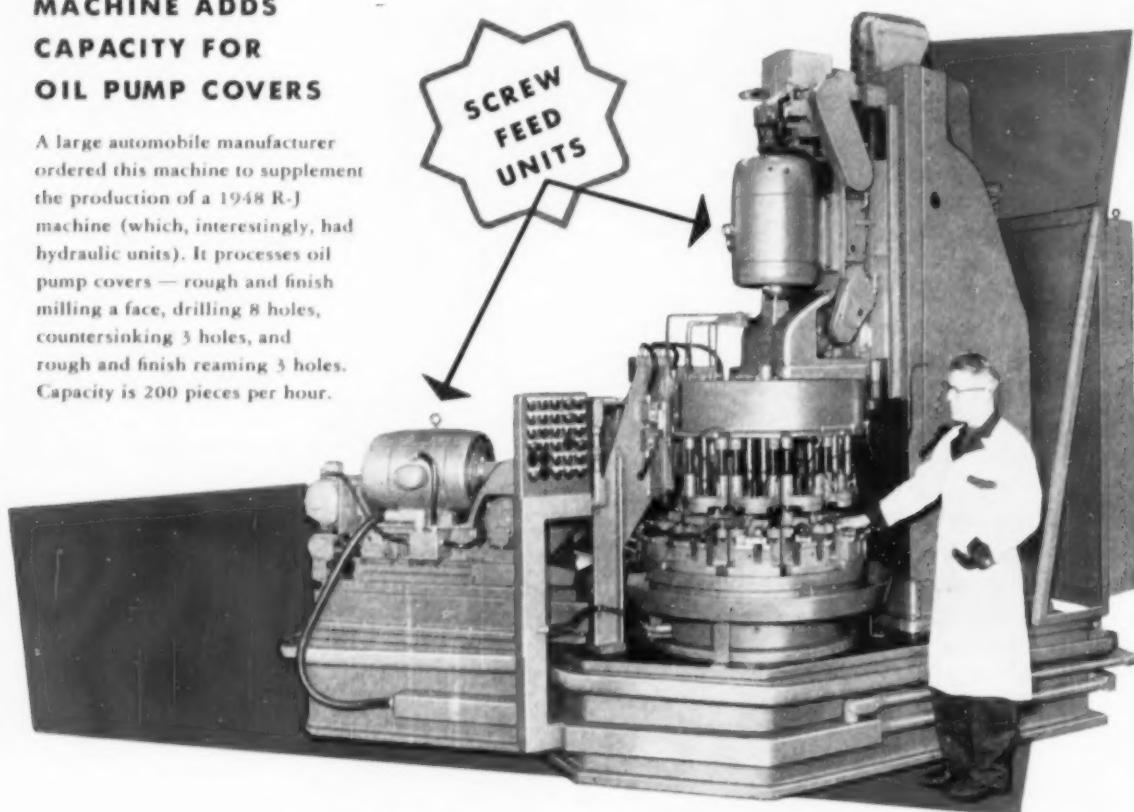
## SCREW-FEED UNITS PROVE WORTH; "SPECIFIED" ON NEW MACHINE...

Rehnberg-Jacobson ALL-MECHANICAL Screw-Feed Power Units were carefully investigated by the potential purchasers of this machine — with the result that they *insisted* the Units be included. These Units later proved to be important factors in the final (and favorable) consideration. In many other instances, R-J Screw-Feed Units have shown that they are rugged, reliable, and — most important — *easily understood* by service and maintenance people. These Units operate on the

well-proved feed screw principle, with separate motors driving differential nuts to obtain the desired approach, feed, dwell, and rapid return. An accurate and fast-acting brake is included to insure precise ending of the fast return. As can be seen from the picture, the Unit frame is large enough to carry a husky spindle-drive motor, and the face plate will hold a large multiple-spindle head. *For full details and specifications, write for literature.*

### MACHINE ADDS CAPACITY FOR OIL PUMP COVERS

A large automobile manufacturer ordered this machine to supplement the production of a 1948 R-J machine (which, interestingly, had hydraulic units). It processes oil pump covers — rough and finish milling a face, drilling 8 holes, countersinking 3 holes, and rough and finish reaming 3 holes. Capacity is 200 pieces per hour.



*Designers and Builders of Special Machinery*

REHNBERG-JACOBSON MANUFACTURING COMPANY



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ROCKFORD, ILLINOIS



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**Special Marking** Quick, sure identification of unwrapped steel is now assured by several electro-etch markings on each piece.

And don't overlook these other important reasons why Uddeholm continues to be your most reliable

source for Precision Ground Tool Steel: A tremendous selection of available sizes to meet your needs more closely—Choice of oil-hardening UHB-46 (SAE O1) or air-hardening UHB-151 (SAE A2)—A world-wide reputation of tool steel quality, guaranteeing you the finest performance possible—Ample warehouse stocks and fast service to get your *complete* order to you without delay.

**Write for this handy,  
8½" x 11" stock size chart  
of Uddeholm  
Precision Ground  
Tool Steels**



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Specialty Strip Steels

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Grade	Description	RECOMMENDED			Speed (SFPM)
		Cut Depth	Feed	Speed (SFPM)	
NS-15	Precision Finishing	.004" to .060"	.004" to .024"	250 to 850	
NS-2	General Purpose	1/16" to 1/2"	.005" to .040"	150 to 525	
NS-3 NS-4	Milling and Roughing	1/8" to 1"	.010" to .090"	100 to 500	
NS-65	Heavy Roughing	1/16" to 1 1/2"	.020" to .125"	75 to 200	

FOR CUTTING OTHER MATERIALS					
Grade	Description	RECOMMENDED			Speed (SFPM)
		Cut Depth	Feed	Speed (SFPM)	
NC-2	Precision Finishing	1/16" to 1/4"	.005" to .020"	200 to 1000	
NC-3	General Purpose and Milling	1/16" to 3/4"	.010" to .040"	200 to 1000	
NC-4	Roughing	1/8" to 1"	.020" to .093"	Moderate 80 to 1000	
NC-5	Extra Heavy Roughing	1/16" to 1 1/4"	.040" to .125"	Slow 20 to 150	

FOR HIGH VELOCITY MACHINING					
Grade	Description	RECOMMENDED			Speed (SFPM)
		Cut Depth	Feed	Speed (SFPM)	
NewMet NM-95	Not a ceramic nor a tungsten carbide, but an all new METALLIC CUTTING MATERIAL for cutting steel and other materials	.001" to 1/4"	.001" to .015"	10 to 1500	

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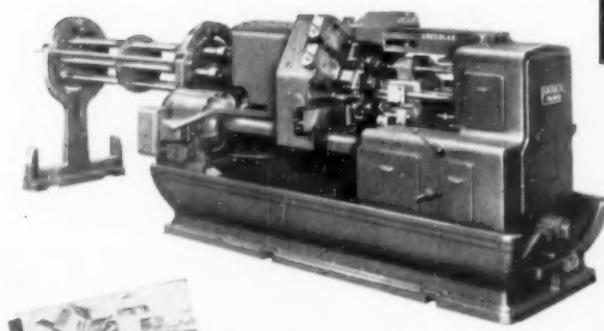
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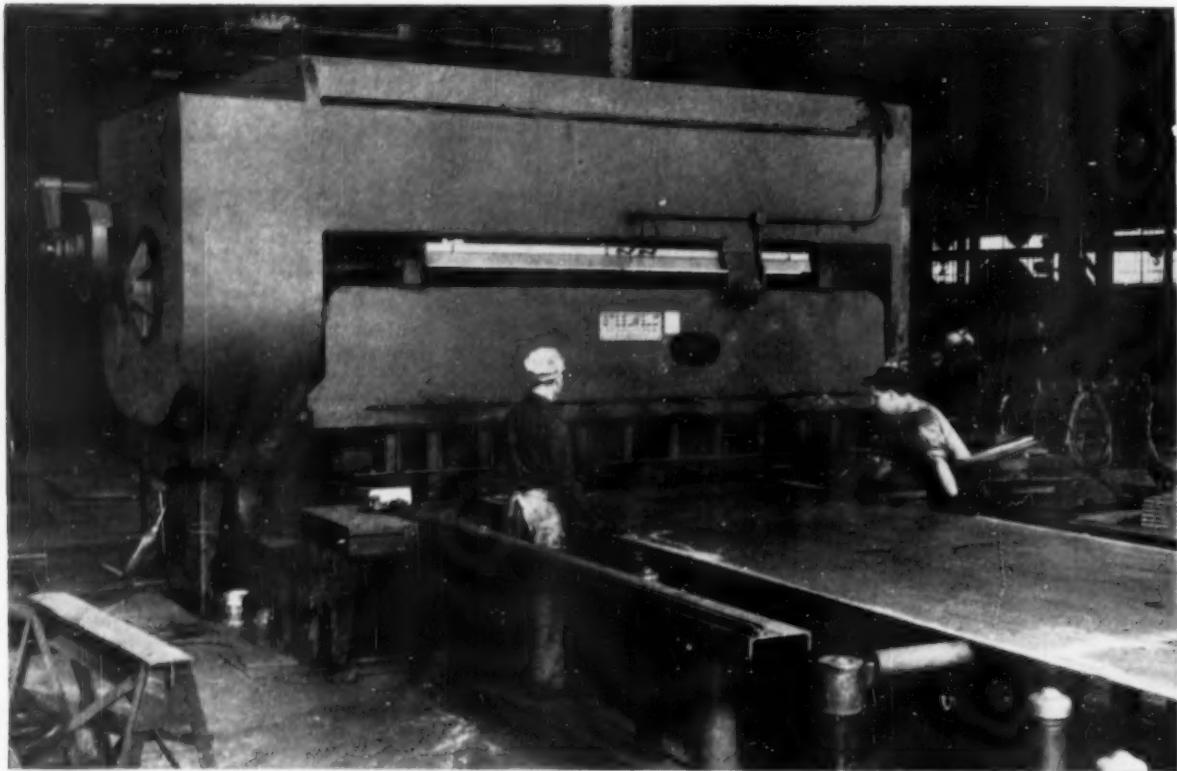
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## Pivoted-Blade Shears Outstanding for Heavy Plates

WHILE Steelweld Shears are used in hundreds of plants for cutting every gauge of metal, it is on heavy plate where the easy accurate cutting action of the machine is really eye catching. With nothing more than a quick "oomph" the knife goes through the metal quickly and cleanly, seemingly without effort. The resulting cut edges are straight and sharp.

Steelweld Shears are now cutting steel up to 1½ inches thick. A wonderful feature is the ease and speed with which the heavy plate machines can be adjusted to cut the lightest gauge metal. In a matter of seconds the clearance between the knives can be reduced to that known to provide the best result for the thickness of the plate being cut. This is done simply by turning a crank

Steel plates up to 10' x 1" are quickly cut on this Steelweld. A complete line of machines is available for every thickness from light gauge to 1½" and every length from 6'-0" to 24'-0".

until a gauge indicator is on the correct thickness figure. This feature is known as MICRO-SET knife adjustment and is the talk of the industry.

Production is fast on Steelwelds because they are heavily built to enable high operating speeds. Also, they are equipped with electric foot control. This reduces operator fatigue and often eliminates many steps he must take to the machine.

If you want the most modern machine, with outstanding features that make for the finest in all around performance — tried and proven features, some of which are not obtainable in any other shear — we invite you to get the facts on Steelwelds.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.



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# STEELWELD PIVOTED BLADE SHEARS



# Tool Steel Topics



On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

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## Lustre-Die Takes High Polish For Molding Plastic Rattles

Shreve Molded Products, Youngstown, Ohio, needed an injection mold for the production of heart-shaped parts for baby rattles, using acetate and styrene plastics. They wanted a mold capable of taking a high polish, so as to produce unusually attractive parts. In addition, the mold had to have the stamina to perform economically during long production runs.

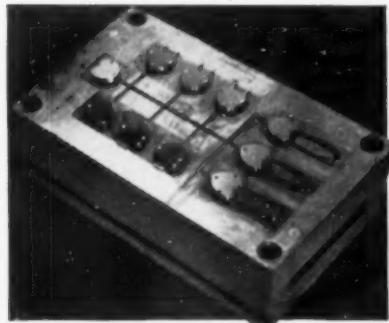
The problem was put up to Leed Steel Co., Buffalo, N. Y., Bethlehem's local tool

steel distributor. Their recommendation was Lustre-Die tool steel. It proved to be an excellent choice, too, for the mold, which was produced by Tri-Penn Tool Co., Erie, Pa., has been satisfactory in every way.

Lustre-Die is ideal tool steel for producing plastic parts because its properties enable it to take an unbelievably bright, mirror-like polish. Not only does Lustre-Die have the proper basic analysis for working with plastics—we even go a step beyond that by adding alloy fortification. We also build up the steel's excellent properties by oil-quenching and tempering, so that it can be furnished ready for machining and polishing.

Lustre-Die is made in the electric furnace, and is carefully inspected to insure cleanliness. It has a minimum of inclusion-causing additions. Besides, modern inspection methods hold injurious porosity to the minimum.

If you have any questions about Lustre-Die, or if you would like to give it a trial run, your Bethlehem tool steel distributor will be pleased to assist you.



## BETHLEHEM TOOL STEEL ENGINEER SAYS:

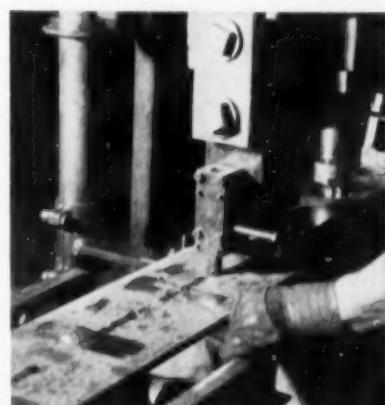


*It Pays to Keep Tools Sharp*

In many shops, resharpening of production cutting tools is sadly neglected. In an effort to keep output high, too many tools are kept in use beyond the point where the cutting edges become excessively dull.

What happens when edges are dull? The dull edges cause an increase in the service load of the shearing or cutting operation. If the dullness is carried to extremes, tools break. Dull edges also produce rough surfaces on the parts, which may lead to rejections due to defects, or because the permissible tolerances have been exceeded.

Should resharpening be delayed too long, it may be impossible to recondition a tool properly, as deep spalls, cracks and gouges cannot be removed. Usually there is an economic balance point where it is best to resharpen, and for each operation this should be determined in advance. Tools should also be inspected regularly, to prevent excessive dulling. Intelligent use of preventive maintenance of cutting edges can work wonders in providing longer tool life and fewer broken tools.



**Bearcat Puts Square Holes in 1/2-in. Plate**

In this operation, photographed at Frink Sno-Plows, Inc., Clayton, N. Y., Bethlehem Bearcat is putting 11/16-in. square holes in carbon-steel plate, used as cutting edge of snow plows. Though the steel plate is 1/2 in. thick, the average life of each punch is 5500 holes.

MAKES *Tough Set-up Jobs EASY*



Types to fit  
any machine  
used for  
tapping or  
reaming.

When things go wrong on some particular tapping or reaming operation, and work keeps coming through with oversize or bell-mouthed holes, don't be licked! The main trouble probably lies in the tool holder you are using. Unless it compensates for inaccuracies in set-up as the Ziegler Holder does, faulty work is bound to be the result.

So, if you have a particularly tough job, change over to the Ziegler Floating Holder. You'll be surprised at how it will smooth out your difficulties.

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Even the smallest shop can rapidly pay for this versatile instrument in time and materials saved. UNITRON Model TM, with all its features, costs about the same as the low-cost priced, simple shop microscope. **\$1050**

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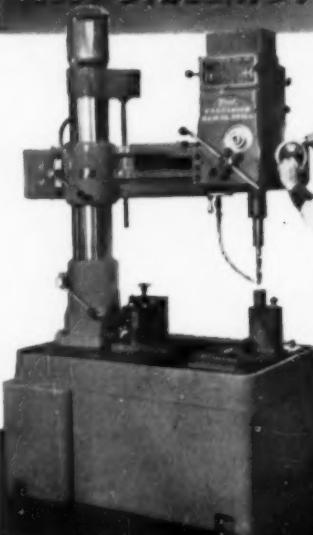
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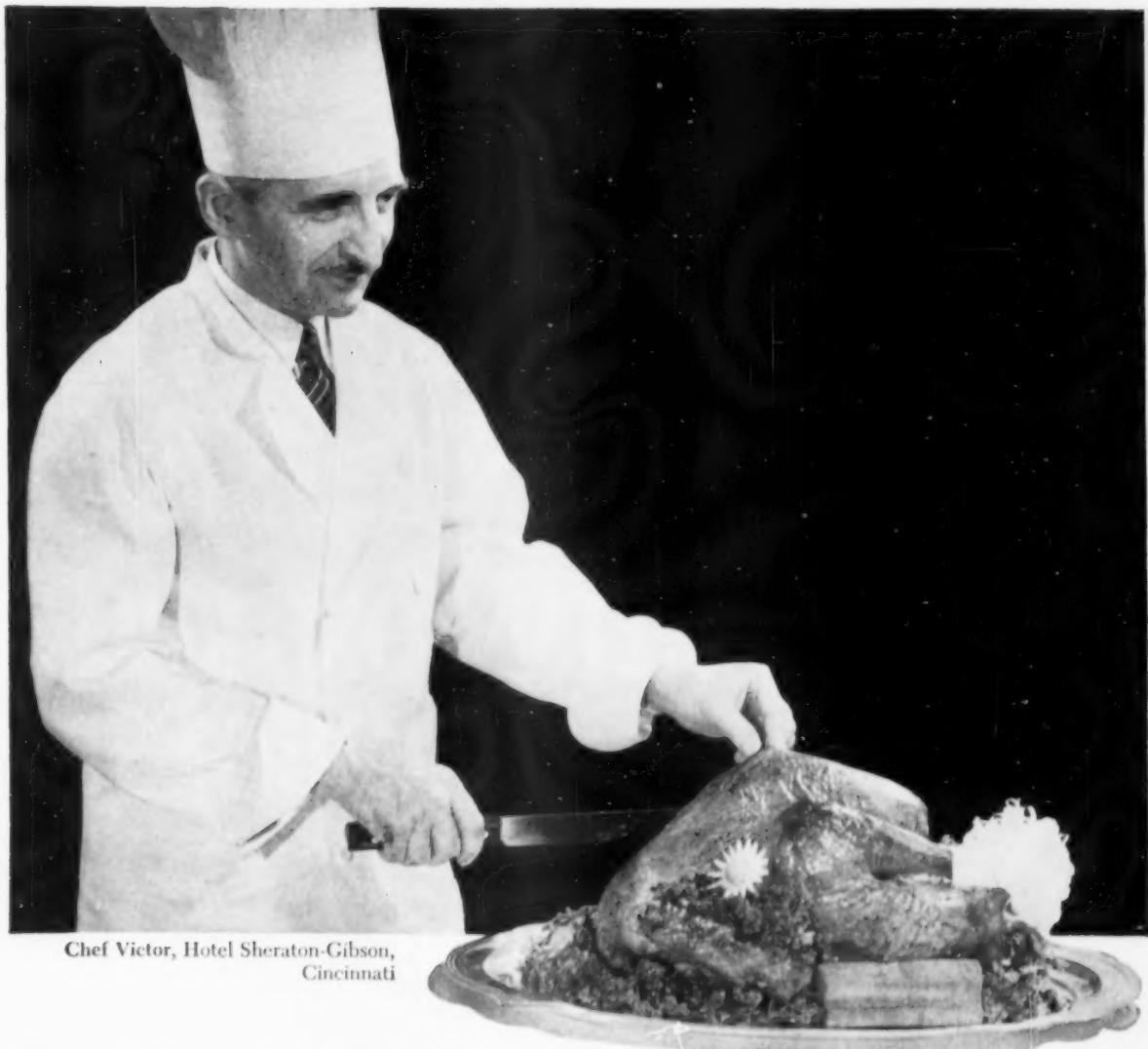
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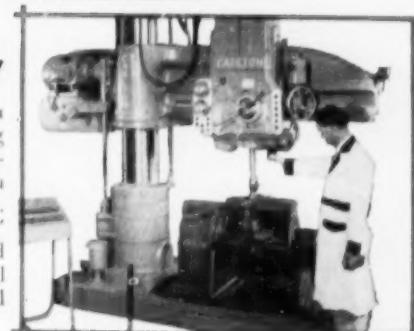
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CARD ON PAGE 175.



Chef Victor, Hotel Sheraton-Gibson,  
Cincinnati

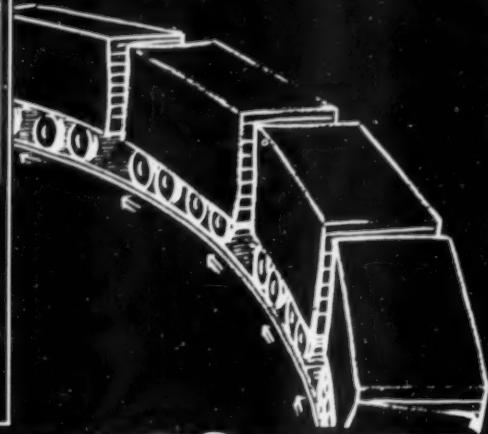
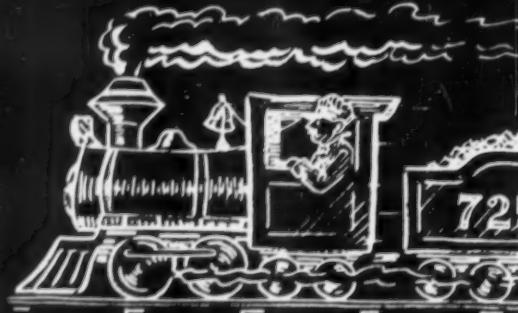
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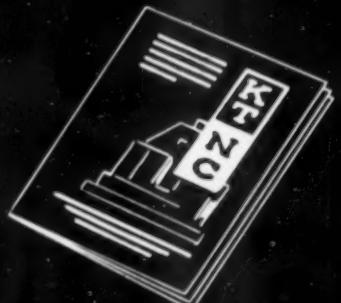


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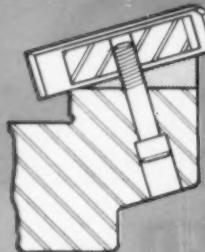
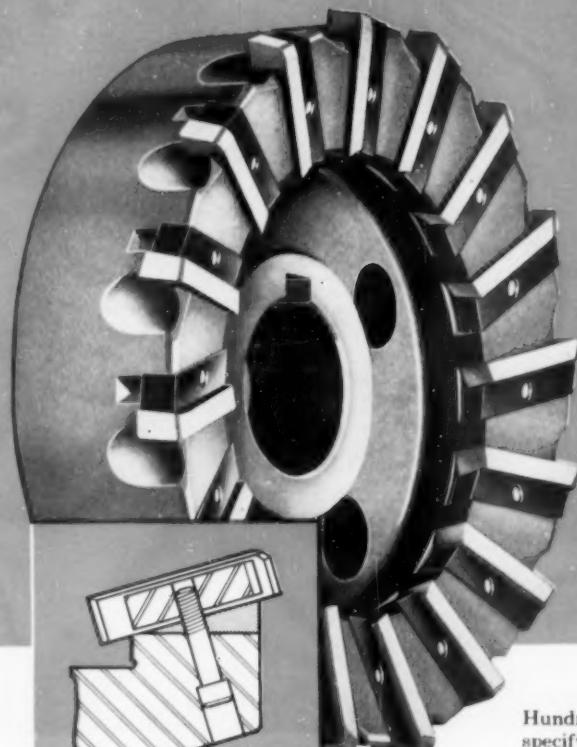
# "10 YEARS ON THE JOB

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### SUPER IBH CUTTER

For aluminum, steel, most other metals. All the features of our HPH Cutter except

- Blades are at 10° positive angle to radius

- Number of blades is diameter + 2.

For efficiency, select the correct grade of carbide for the metal, grind to the proper angle. Your Super IBH Standard Cutter will do the rest!

Hundreds of tool men everywhere tell us willingly *why* they specify Super HPH and IBH Standard Milling Cutters. As a tool engineer, machinist or tool buyer you'll value these reasons why many shops have worked Super cutters for over ten years, always with economy and quality.

Here's why: For high speed machining of cast iron, malleable iron or brass, our HPH cutter has big *solid* carbide blades for maximum strength and elimination of braze strains. Blades are set radially, the number being the diameter  $\times$  2. You sharpen with a minimum removal of carbide—not the  $\frac{1}{16}$ " you lose with serrated-back blades—as Super blades can be moved a few thousandths or less at a sharpening. Then after scores of sharpenings, you use the carbide down to a stub because our wedge (with a filler-blade) gives you a locking area the complete length of the slot. The blade is solid as though part of the body itself since there are no back-up screws. If a wreck occurs—as it may in the best of shops—only the wedge is damaged or scrapped, not your cutter body. There are no threads in the body to strip as our wedges are tapped to take locking screws let in from the back.

The Super cutter body is #4130 Steel, heat treated for optimum strength. Drift pockets are machined under wedges for quick removal or adjustment. Mounting is versatile; it may be bolted on a #50 NMTB mount and it also has a keyway and ground bosses for arbor mounting.

Why not write for our complete catalog of solid and carbide tipped tools and the name of our stocking distributor near you. Thousands of satisfied tool buyers *must* be right; we'd like to have you join them.

# Super

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MARKS THAT TELL YOU  
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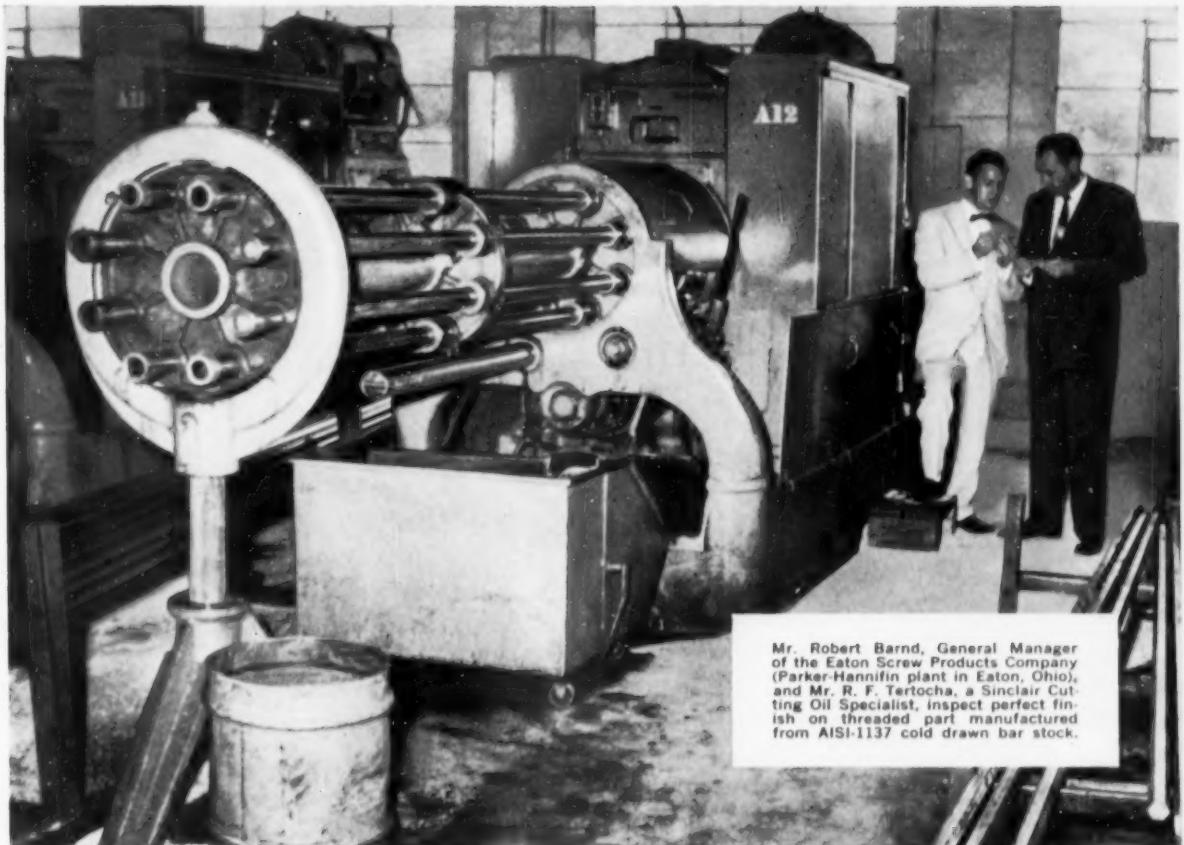
**PARKER-KALON DIVISION, General American Transportation Corporation**

*Manufacturers of Self-tapping Screws, Socket Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws*

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*Sold Everywhere Through Leading Industrial Distributors*

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Mr. Robert Barnd, General Manager of the Eaton Screw Products Company (Parker-Hannifin plant in Eaton, Ohio), and Mr. R. F. Tertocha, a Sinclair Cutting Oil Specialist, inspect perfect finish on threaded part manufactured from AISI-1137 cold drawn bar stock.

## EATON REPORTS 5 ADVANTAGES WITH CLAIRO® 16...

"Why use 3 different cutting oils on your automatic screw machines when one will do the trick?" That's how R. F. Tertocha introduced Sinclair's new cutting oil, CLAIRO 16, to Bob Barnd. And that's when Eaton Screw Products Company started to cut their costs.

**5 DISTINCT ADVANTAGES** After switching to CLAIRO 16, Mr. Barnd enthusiastically reported these 5 distinct advantages . . .

- 1 One oil for all metals which Eaton machines.
- 2 Reduction in cutting oil and lubricating oil inventory.
- 3 No contamination of non-corrosive oils with corrosive types when chips pass through chip wringer.

- 4 No need to remove cutting oil from machine reservoir when machine is set up to run either ferrous or non-ferrous parts.

- 5 Light color makes it possible for operators to see readings on calipers, scales and micrometers.

**DUAL-PURPOSE OIL** Of further importance to Eaton—this high-quality oil can also be used as a machine tool lubricant. CLAIRO 16 replaced the lubricating oil Eaton was using on a battery of 31 automatic screw machines.

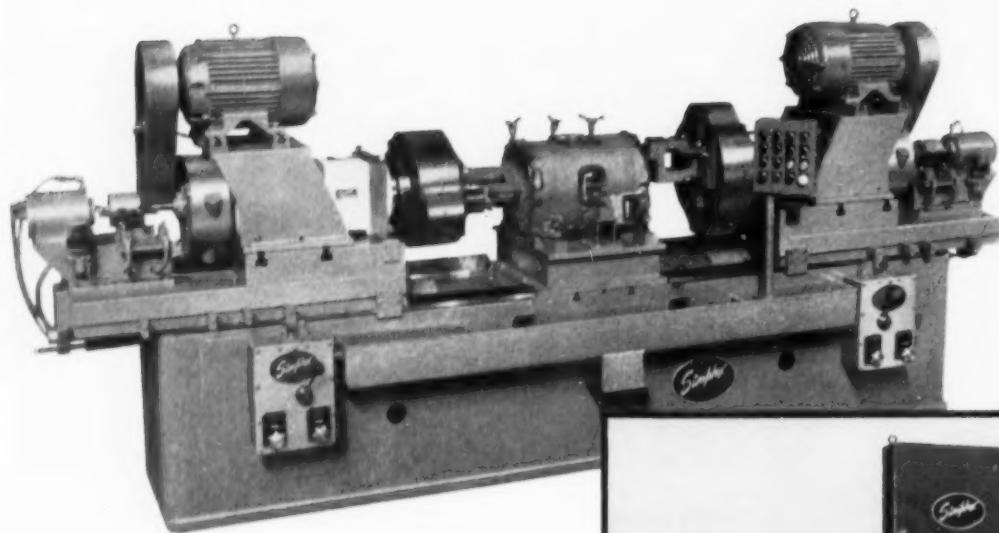
You, too, can benefit from the advantages of CLAIRO 16. Contact your local Sinclair Representative or write Sinclair Refining Company, Technical Service Division, 600 Fifth Avenue, New York 20, N. Y. *There's no obligation.*

# SINCLAIR

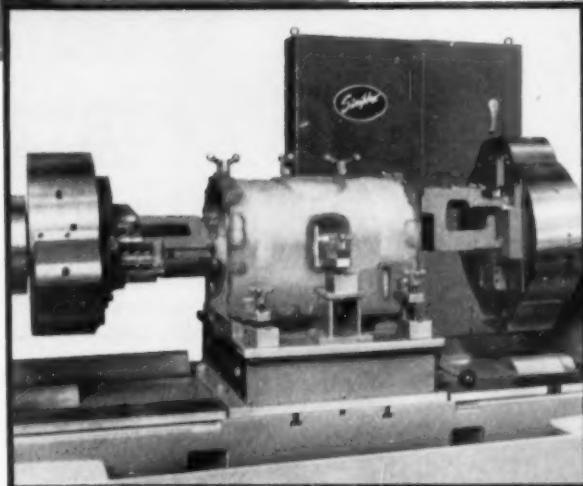
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Craftsmen at Staples of Cincinnati have been making finer carbide tools for twenty years and more. Behind each tool coming from the ultra-modern Staples factory is a long standing tradition of superior workmanship—your assurance that a Staples tool will cut production costs.



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(PATENT APPLIED FOR)



# NEW MANHATTAN SAFETY BACK FLARED CUP

Not simply a new safety "feature" . . . not merely a design "improvement." Here's a *totally new concept* of flared cup wheel design and construction . . . developed by Manhattan engineers to give the greatest safety and performance advantages possible for flared cup wheel users. Manhattan's revolutionary SAFETY BACK Flared Cup puts portable wheel safety where it counts the most—in *original* strength and breakage resistance!

SAFETY BACK far surpasses ordinary safety features such as anchor bushings, safety rings, special hub mountings, or revolving cup guards. With SAFETY BACK, steel covers the *entire* back of the flared cup . . . extends down the side to offer a degree of reinforcement and breakage resistance never before possible!

#### NO OTHER WHEEL—AT ANY PRICE— OFFERS THESE EXCLUSIVE FEATURES

- Greatest Initial Strength
- Easy Mounting—Easy Operation
- One Piece Assembly
- Highest Safety Factor
- Improved Mounting Base
- Requires No Adjustment

Only SAFETY BACK gives you these features—*plus* Manhattan's custom-engineered abrasive bond for *faster* removal of *more* metal on your particular job—at no additional cost! For "More Use per Dollar" in portable grinding operations, you can't get a faster cutting, longer lasting—*safer* wheel than MANHATTAN.

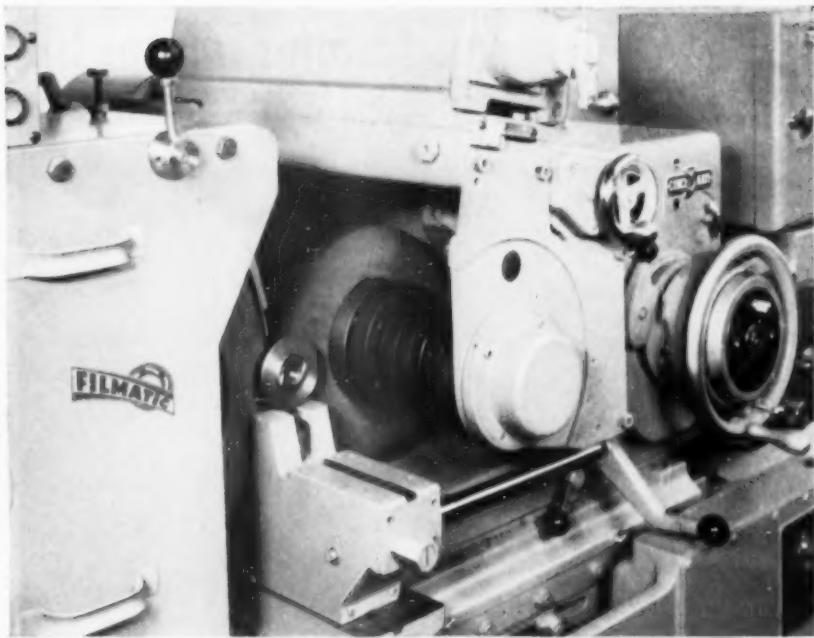
Let a Manhattan abrasive wheel engineer show you the advantages of SAFETY BACK Flared Cups, and other types of Manhattan high speed, heavy duty abrasive wheels. Write for Bulletin 7157.



WRITE TO THE ABRASIVE WHEEL DEPARTMENT

MANHATTAN RUBBER DIVISION—PASSAIC, NEW JERSEY  
**RAYBESTOS - MANHATTAN, INC.**

Belts • Hose • Roll Covering • Tank Linings • Industrial Rubber Specialties • Abrasive and Diamond Wheels • Brake Blocks and Linings • Clutch Facings • Asbestos Textiles • Mechanical Packings • Engineered Plastics • Sintered Metal Products • Industrial Adhesives • Laundry Pads and Covers • Bowling Balls



Several automatic features incorporated in this CINCINNATI FILMATIC No. 2 Centerless Grinder reduce nonproductive time in centerless grinding two diameters on turbine shafts.

## Nonproductive Chores are Automatic ... on this Cincinnati Centerless

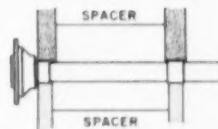
Give the operator an assist with nonproductive chores and he'll accomplish more. One way to do it is to automate as many nonproductive elements as possible in the cost of machining. Cincinnati grinding specialists proceeded along these lines in equipping a CINCINNATI<sup>®</sup> FILMATIC No. 2 Centerless to grind two diameters on turbine shafts. Automatic features for reducing nonproductive time include:

- Automatic profile truing for grinding wheel, including cycle counter
- Automatic grinding wheel balancing
- Automatic grinding wheel reciprocating, with truing interlock
- Automatic Electro-Hydraulic Infeed

These cost-reducing features are in addition to well-known Cincinnati advantages such as bed rock mounting of grinding wheel spindle; FILMATIC grinding wheel spindle bearings; double slide support for the regulating wheel unit. Cincinnati is unquestionably the best buy for your precision centerless grinding work. Get additional details by asking for catalog No. G-644-2, or look in Sweet's Machine Tool File for brief specifications.

**CINCINNATI GRINDERS INCORPORATED**  
**CINCINNATI 9, OHIO**

# CINCINNATI



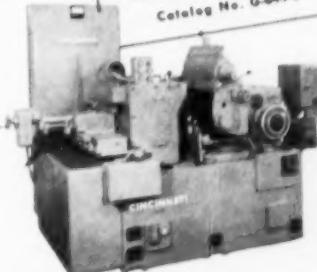
Drawing of part showing diameters ground.

**Production Data:**

Part name .....	Turbine shaft
Material .....	Steel
Stock removal .....	.010"
Production .....	150 parts per hour

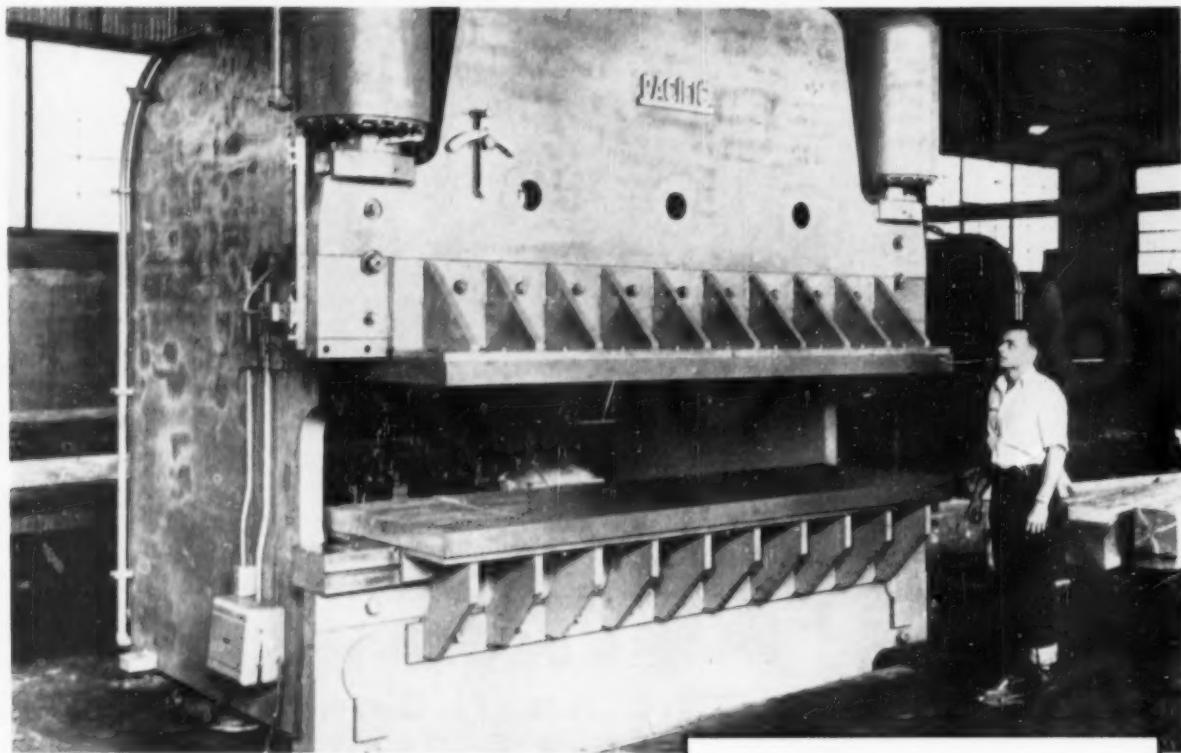


**CINCINNATI FILMATIC  
No. 2 CENTERLESS  
GRINDING MACHINE**  
Catalog No. G-644-2



CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL  
GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS  
MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPING MACHINES

# SAVES \$300 a day forming metal from \$9.20 a day investment in Pacific Hydraulic Press Brake



500 feet per day of 14 gauge stainless steel pipe originally sub-contracted for fabrication by conventional methods is now manufactured by Hazen Engineering Co., Pittsburgh, Penn., in their own plant on a Pacific Hydraulic Press Brake at a saving of 60¢ per foot. The brake paid for itself out of savings in 92 working days. The total investment is amortized at \$9.20 per day.

The Pacific is used in a variety of operations at the Hazen plant equally as profitably. Any metal working plant, large or small, can also profit from owning a Pacific. If you do forming and would also like to do blanking, deep drawing, embossing, punching, straightening, stretching, extruding, hot forming or shearing, it will pay you to investigate the hydraulic press brake that pays for itself. There is a Pacific model size to suit your needs.

Sequence of pipe making operations on Pacific Hydraulic Press Brake



① preforming, ② "U"ing,  
③ closing pipe. Each pipe  
10 ft. long.

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MANUFACTURING COMPANY

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HYDRAULIC BRAKE

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is a factor...*

*...use*



## CARBIDE PLUG GAGES

### TUNGSTEN CARBIDE

wire type .010" to .760" diameter\*

### TUNGSTEN CARBIDE

taper lock type .365" to 1.510" diameter

In addition to its regular line of tungsten carbide wire type plug gages from .010" to .760" diameter, The Van Keuren Co. now offers a line of tungsten carbide taper lock plug gages in the range from .365" to 1.510" diameter.

Van Keuren tungsten carbide wire type gages have proved

Send for a copy of the new, 258 page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:



THE *Van Keuren* co.

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Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . .  
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Plug Gages . . . Carbide Pivots . . . Precision Lapping Service.

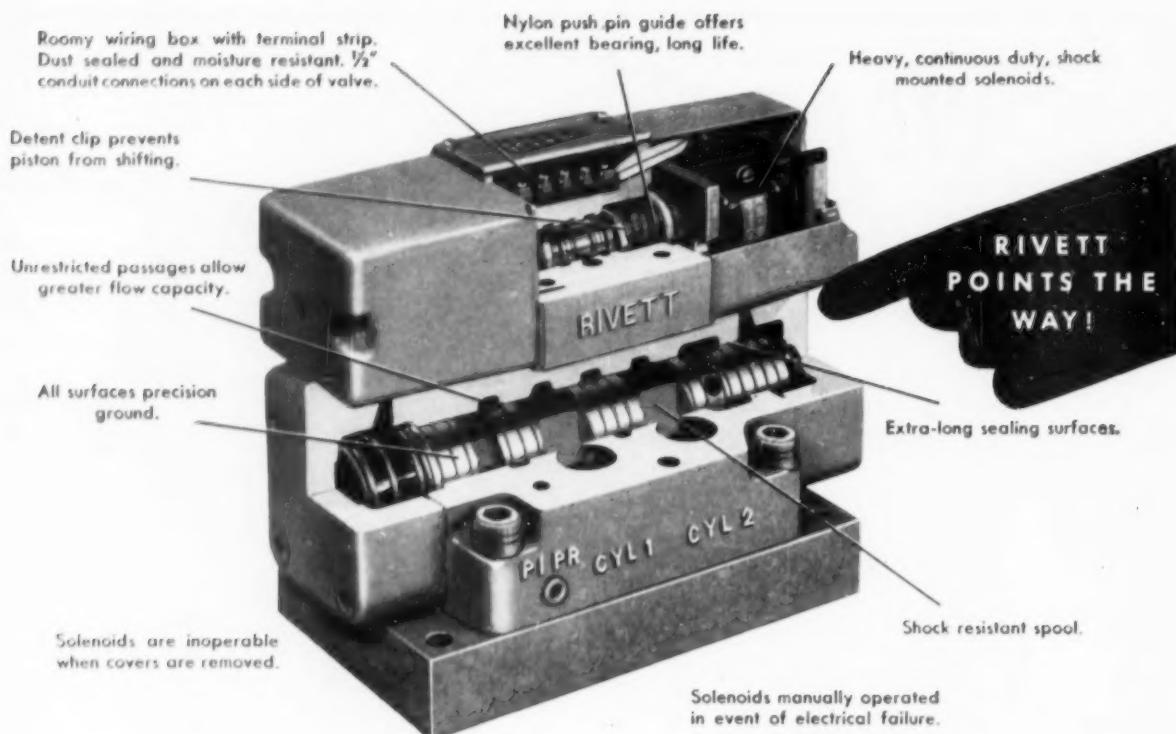


their worth on thousands of tough gaging jobs. VK tungsten carbide taper lock gages are similarly effective. If wear is a factor in your overall gage costs, you can save money by using VK carbide plug gages.

Finish on VK gages in either the wire type or taper lock type in tungsten carbide will average .5 RMS or better.

These gauges are available in Class Y, X, XX and XXX accuracies at moderate prices and on a reasonable delivery basis.

\*Note full length wire-type member in above illustration.



# High Flow Capacity!

Rivett's New Solenoid Pilot Operated Hydraulic 1" Valve Is Rated at 28 G.P.M. and the 1½" Size At 82.5 G.P.M., At 15 Ft. Per Sec. Velocity.

- Reduces Back Pressure, Friction, Heat
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- Mounts In Any Position
- 3000 P.S.I. Operation for Multi-Million Cycles
- Optional: Built-in Speed Controls  
Explosion Resistant  
Solenoid Enclosures



Get Catalog No. 261 to aid your circuit design. Complete drawings, specifications, cut-away views, tables, diagrams!

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Forget about back pressure by specifying Rivett 6600's for service up to 3000 P.S.I. Reduce inventory! Select off the shelf: 2 basic sizes fit  $\frac{3}{8}$ ",  $\frac{1}{2}$ ",  $\frac{3}{4}$ ", 1", 1½" and 1¾" I.P.S. Single and double solenoid. 7 spool designs. Meet all J.I.C. requirements.

**RIVETT, INCORPORATED • Dept. TE-11**  
Brighton 35, Boston, Mass.

THE BETTER YOU KNOW HYDRAULICS  
THE BETTER YOU LIKE



# How Ehrhardt's part in "the new precision" can benefit you

LIFE Magazine some months ago saluted the Ehrhardt/St. Louis benchmark in its famous series of articles, *America's Arts and Skills*. Now, FORTUNE Magazine, for August, 1957, highlights *The New Precision*. We urge you to read it for a crystal-clear picture of ultraprecision—which means accuracy to "the thickness of a small microbe".

Since Ehrhardt brought the first precision check gages, dies, jigs and fixtures to the Mississippi 30 years ago, exceptional precision and its measurement have been our aim—indeed, our obsession.

We maintain our tooling facilities at a constant peak. Our equipment includes the latest Moore machine tools for accurate holes, contours and surfaces. Our Elox electrical discharge machining helps satisfy your need for ultrapre-

cision with another up-to-the-minute facility. Operating on the principle of electro-erosion, it removes metals without burning, melting or oxidizing, using a negatively polarized tool on work that is positively polarized. The work piece becomes the anode—the tool, the cathode. Properly used EDM can effect substantial savings over other methods.

As other tooling improvements develop you can depend on Ehrhardt to provide them—and to hold to a minimum the multiplying costs which go with attaining vanishingly small tolerances.

Are you one of "the few who want the most" in advanced precision? If so, call on Ehrhardt. Join the elite among manufacturers for electronics, aviation and automotive industries who use Ehrhardt's triple plus tooling service.\*



\*Profit by Precision  
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## triple plus

the complete picture story of what Ehrhardt's combination of tool making skills and full range facilities can mean to you—in profits. Write—right now—for your copy.

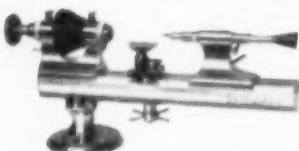


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A nationwide service to the few who want the most in high precision gages, dies, jigs and fixtures

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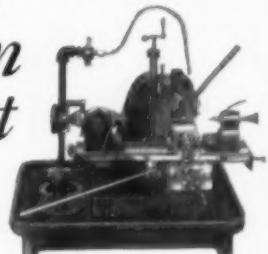
# Derbyshire fine precision equipment



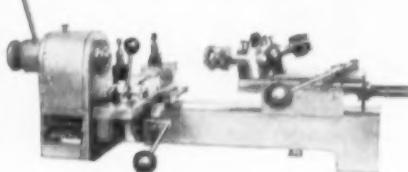
WEBSTER WHITCOMB 12" BED  
Center Height—5 CM, Collet Capacity—.1969"



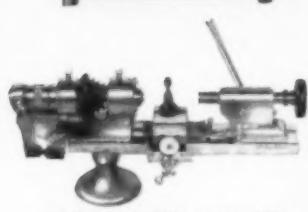
ELECT LATHE—18" BED  
Center Height—2.35" (6 CM)  
Chuck Capacity—.004" to .315"



MICROMILL  
2 Table Surfaces: 7 $\frac{1}{2}$ " x 2 $\frac{3}{8}$ " — 12" x 2 $\frac{3}{8}$ " — Takes  
Magnus Collets.



MODEL No. 750—22" BED  
Center Height—7.50 CM, Collet Capacity—.315"

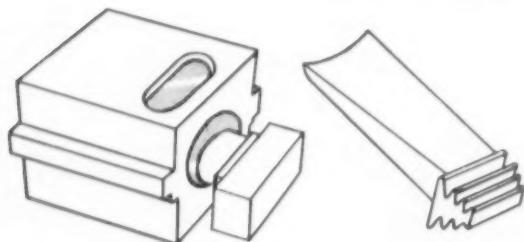


MAGNUS LATHE—12" BED  
Center Height—5 CM  
Collet Capacity—.315"

F. W. DERBYSHIRE, INC.  
157 HIGH STREET  
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If you have a problem...  
... concerning small precision  
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lathes or the milling machine  
shown should solve it. Write  
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Hold irregular workpieces rigidly  
by nesting them in CERRO ALLOYS



The unique combination of low melting temperature and non-shrinking qualities in CERRO ALLOYS make them an excellent nesting matrix in jigs, chucks and fixtures for irregular shaped pieces. The illustration shows how a jet engine "pinetree" turbine bucket can be held snugly in a special fixture for grinding. After locating the bucket

properly in the large cylindrical hole, the latter is filled with molten Cerro Alloy. After grinding the bucket, it is removed from the fixture by melting out the matrix in hot water. In such applications the low melting temperature of the Alloy eliminates all danger of annealing or burning the workpiece.



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## NEW—Full 180° Mitre Gauge Tool Rest

### for sharpening carbide tools

Angle-Set<sup>®</sup>, an accurate tool sharpening rest, for use on ground table of carbide tool grinders. Four-way positioning permits change for right or left use on wheel and permits accurate grinding of extremely large or extremely small angles between tool cutting edges. Has accurate degree markings and position locking screws.

\*Patent Pending

Only \$16.00 Postpaid

Also furnished as standard equipment with Model 06 Coolie-Grind erlap for rough grinding and Re-Lod-Able Diamond Wheel finish grinding of Carbide Tools.

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Accurately holds tool at any angle.

DIAMOND TOOL CO.

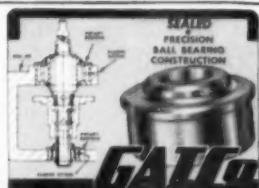
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## Top Performance Throwaways

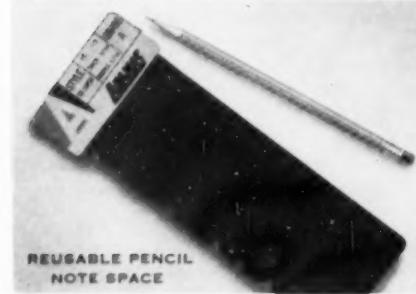


now packaged to give you extra production efficiency

*Check these outstanding features:*



DECIMAL EQUIVALENT CHART  
AND RADIUS GAUGE



REUSABLE PENCIL  
NOTE SPACE

### Insert Protection

Heavy 30 - gauge acetate construction gives 3 times the protective strength of any other method of insert packaging. Individually-formed plastic pockets to fit Adamas' wide range of square, triangular, and round throwaway inserts.

### Operator Features

**One-glance inventory**— clear transparent plastic provides easy check of insert stock.

**One-at-a-time dispensing** by easy open slide.

Decimal equivalent chart and ruler protected by a full 1/32" covering of clear plastic ensures clean, clear readability through the hardest of use.

**Radii gauge** for convenient and accurate spot checking of corner radii.

**Reusable pencil note space** with unique silicate surface finish provides an always-handy (and erasable) surface for those important job notes and sketches.

Test these features yourself . . . discover how they can add extra efficiency and operator convenience to your own production system.

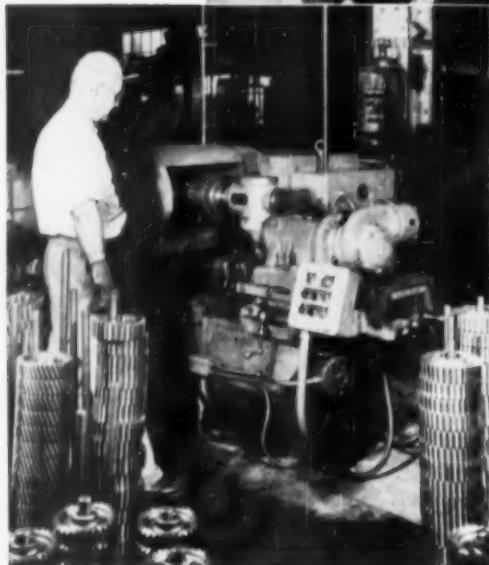


**ADAMAS**

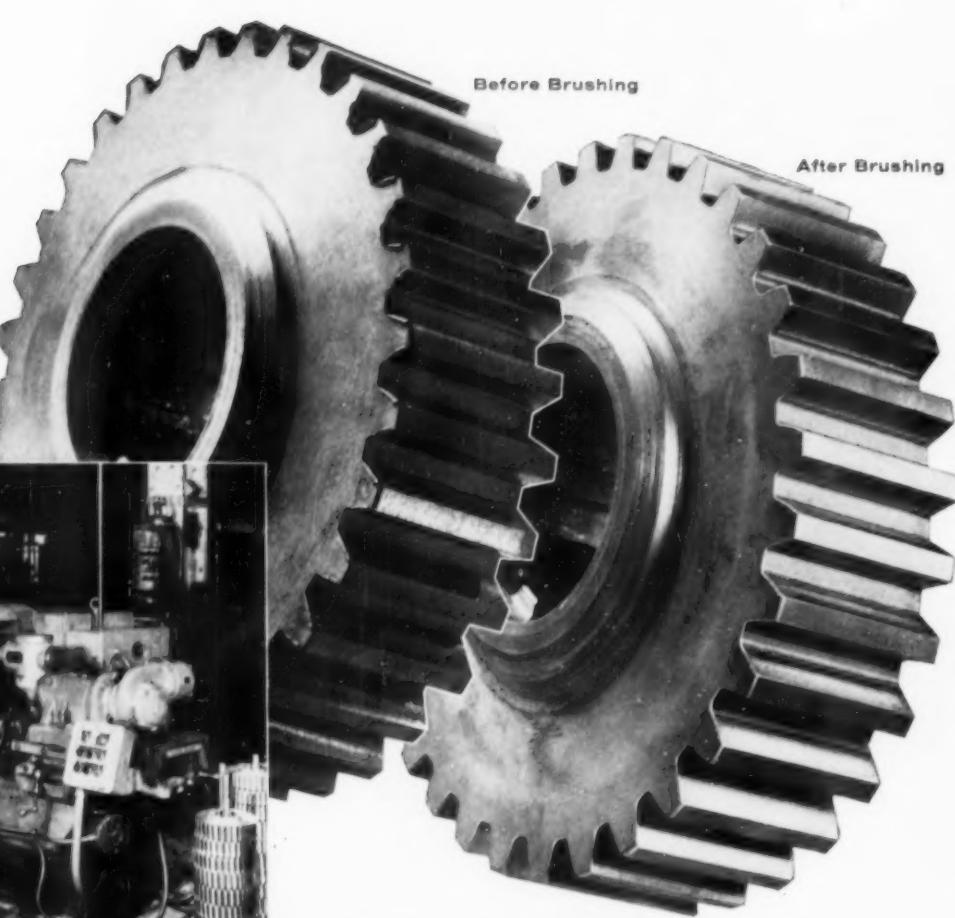
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CORPORATION

KENILWORTH, NEW JERSEY

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*A leading machine company, supplying gears for mining and a variety of other heavy machinery, uses Osborn's Brushamatic 4 and a brushing cycle of 6 seconds a side to finish these gears in lots of 20 and up.*



**Pays Off...**

**25 for 1**

REMOVING burrs from the teeth and internal spline of this gear was once a 5 minute, hand filing operation. Using Osborn Brushamatic® methods, only 12 seconds are required to remove these burrs. In addition, power brushing blends all surface junctures, reducing fracture-causing concentrations of stress.

An Osborn Brushing Analysis, made in your plant and at no obligation, will show how you can improve quality while making similar savings in finishing time and cost. Write *The Osborn Manufacturing Company, Dept. K-40, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

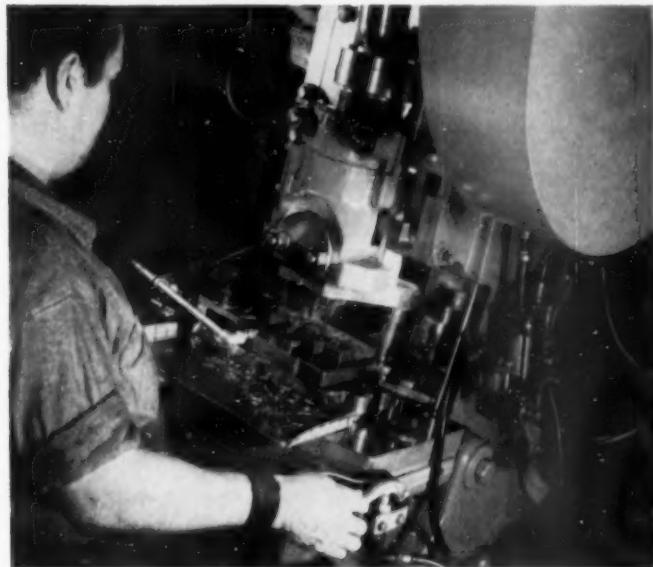


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BRUSHING MACHINES • FOUNDRY PRODUCTION MACHINERY

*Osborn Brushes*®



## This Danly V-punch holder die set gives clear picture of this critical forming operation



The operator hand feeds blanks into this precision forming die . . . produces pieces by the tens-of-thousands for use in telephone relays . . . and must be sure that piece part position and die function is correct each time.

For greatest safety, the die is mounted in a Danly Precision V-Punch Holder Die Set. The V-Punch holder gives the operator full view of the die area right up to the instant of die closure. And, as with all Danly Die Sets, reliable die set precision assures maximum protection of the die and longer production runs.

There's a type of Danly Precision Die Set to meet your requirement. All are quickly available in standard sizes from Danly Branch Assembly Plants and leading distributors throughout the country. Get the right die set for your job . . . right when you want it. Specify Danly.

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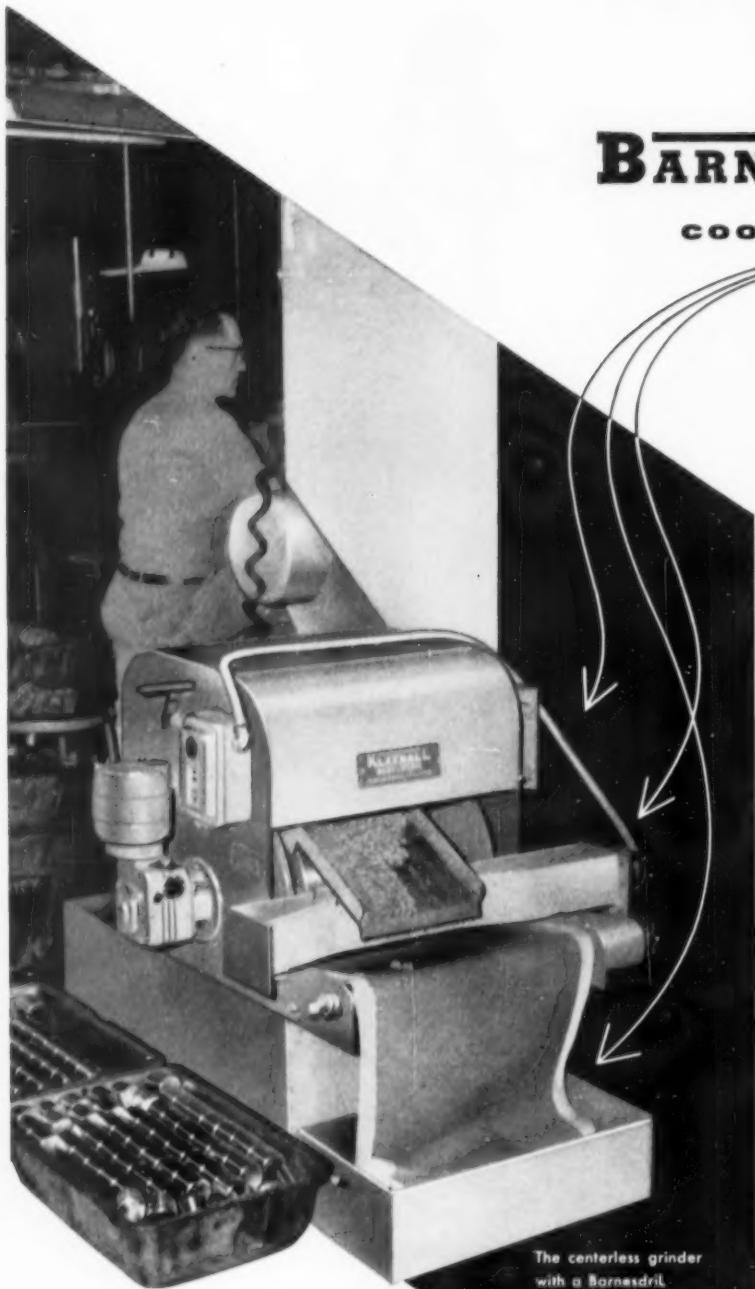
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## coolant filters

provide  
competitive  
quality  
advantage

"Savings are secondary to the quality control we have gained in the use of Barnesdril Kleenall Filters. The Filters have allowed us to keep ahead of our competition in the quality of our product."

This statement was made by the plant superintendent of a prominent roller bearing manufacturer. A centerless grinder (shown) and a super finisher are used for surface finishing and bringing bearings to their final accuracies. Both are equipped with Barnesdril Kleenall Combination Magnetic and Fabric Coolant Filters. The bearings, used in guided missiles, aviation electrical motors, and transportation equipment, are finished to 2 to 3 RMS micro-inches. Size must be held to  $\pm .000025$ ", and their crowns held to .00001", checked by electronic measuring device.

By filtering the recirculated coolant through Kleenall Filters, definite production savings are also accrued. Less coolant and less labor are required and equipment lasts longer. If quality control or extreme accuracies are part of your production requirements, consult a Barnesdril Engineer about the advantages of Kleenall Filters.

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The result of modern research, design and engineering know-how, this powerful O-M component figures importantly in today's automation picture. Its high operating efficiency and ease of maintenance combine with its space-saving design and rugged construction to make it highly desirable in any application where its capacity meets specifications. Ports are easily oriented to any position.

*O-M Air and Hydraulic Tie-Rodless Cylinders are available in a complete range of sizes (1½" to 8" bores) with standard or heavy duty rods. Completely interchangeable parts and mounts. Immediate delivery on many sizes.*

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Consult an Ortman-Miller representative regarding your pneumatic and hydraulic problems. His broad experience with standard and special cylinder applications is available to you without cost or obligation. Use convenient coupon for name and address of O-M representative nearest you.

**ORTMAN-MILLER MACHINE COMPANY**  
13 143rd Street, Hammond, Indiana

- Have representative call
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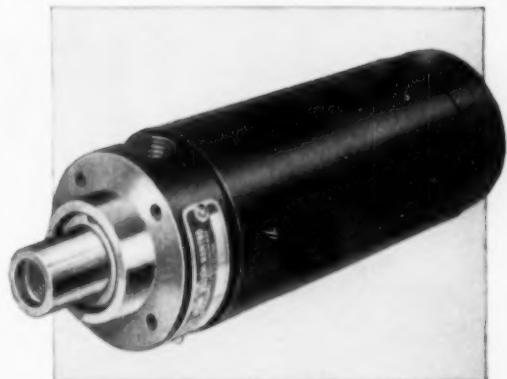
Name \_\_\_\_\_ Position \_\_\_\_\_

Company \_\_\_\_\_

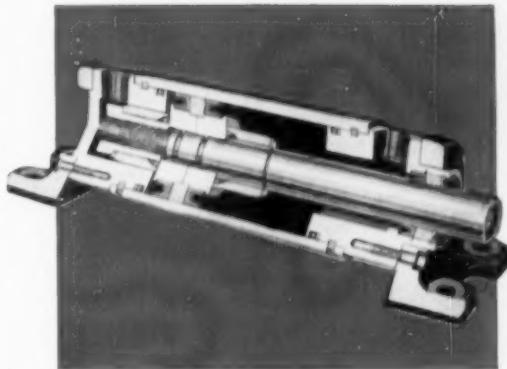
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**O-M Tie-Rodless  
Cylinder 150 psi Air  
Up to 1500 psi Oil**



**Meets JIC Standards**



**Fits Where  
Others Won't!**

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*Vulcanaire*

Provide yourself with this inexpensive\* instrument for use on your present equipment and JIG GRIND with a guarantee.



A five station indexing fixture from Vulcan's Contract Tool Room (Your tool room in Dayton).

Using a jig borer index table with the Vulcanaire 5 indexing holes and 35 locating and clamping holes were JIG GROUND in place. Result — eliminated all close locating and dowelling of individual parts and of course hours of time.

\*Vulcanaire equipment pays for itself on the first job.

Borrow our instructive  
11 minute movie on  
Jig Grinding.

*Services of your Tool Room in Dayton*

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VULCAN  
tools

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Economize  
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MAYLINE  
CO., INC.

611 No. Commerce St.  
Sheboygan, Wisconsin



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SAVES US \$30.00  
A WEEK!**

on basis of  
actual usage

**DO IT  
WITH  
MANY SPECIAL  
HARD ABRASIVE  
MATERIALS POSE  
NO PROBLEM IN USE**

**CAN BE  
RESHARPENED  
MANY TIMES**

**RESHARPENING  
WILL OUTLAST  
APPROXIMATELY  
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STEEL HAND FILES**

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ECONO-BLADE**

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CUTTERS**

Ask for a Severance catalog today!

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# Index of THE TOOL ENGINEER Advertisers

November 1957 Issue

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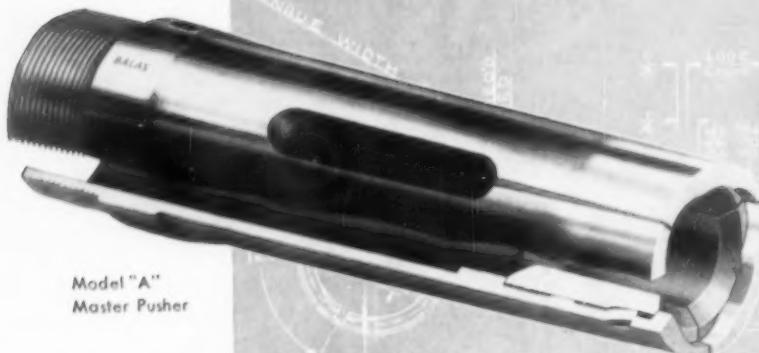
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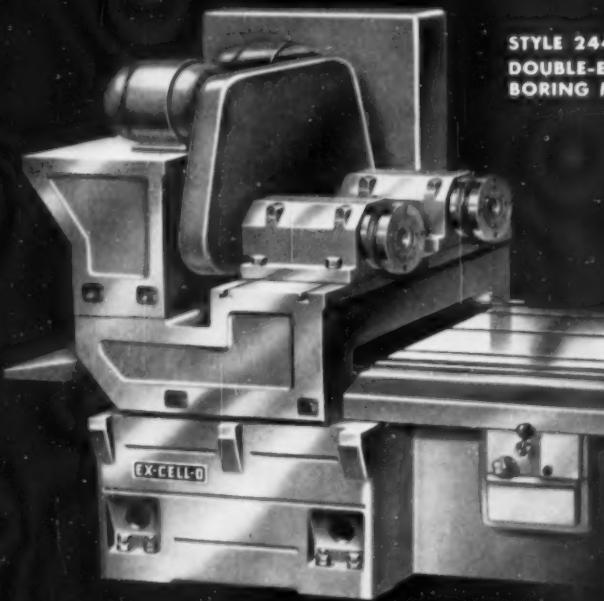


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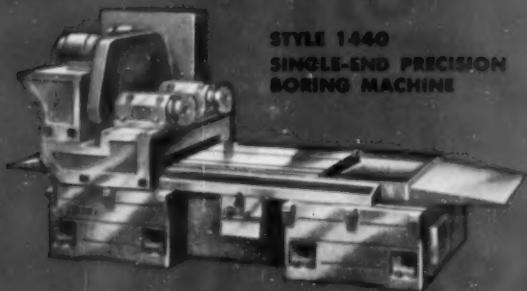
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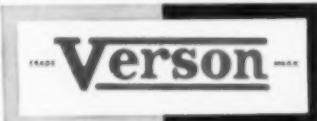
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